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NOVEMBER 1952

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RESERVE'S TACONITE: On-the-scene progress report in pictures . . P. 72

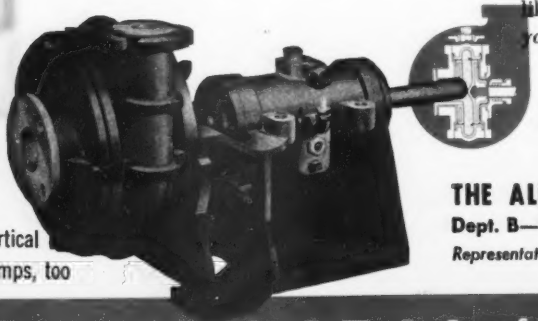
AFRICAN TIN: Geomines' goal is 1,000 tons of ore per hour . . . . . P. 86

INDUCED RADIOACTIVITY: How it can separate minerals . . . . . P. 95

COMMUNIST HEARINGS: Mine-Mill wouldn't talk at Salt Lake . . P. 124

How we know what Hydroseals will do for you

Engineering and guesswork don't get along very well together—at least, not for long. To keep guesswork out of Hydroseal engineering, we've kept complete performance records on almost every pump we've sold. These records contain a description of the pump, its operating conditions, power requirements and all repair parts ordered. Naturally, almost every conceivable pumping condition is included, and the biographies cover a span of years. In most cases, users have found that Hydroseals have paid for themselves in less than a year in power savings alone, with lowered maintenance costs an additional bonus. If you'd like to know what a Hydroseal will do under *your* specific conditions, write us.



Vertical pumps, too

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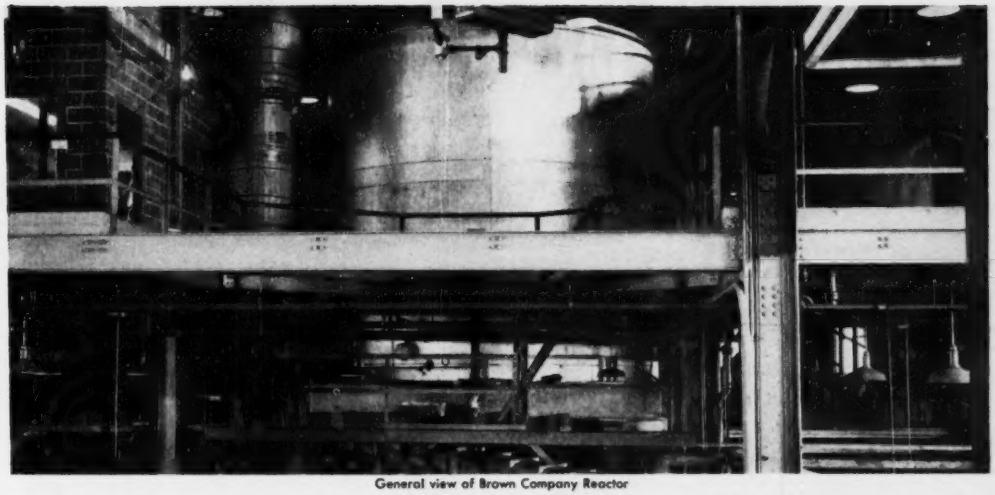
HYDROSEAL SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

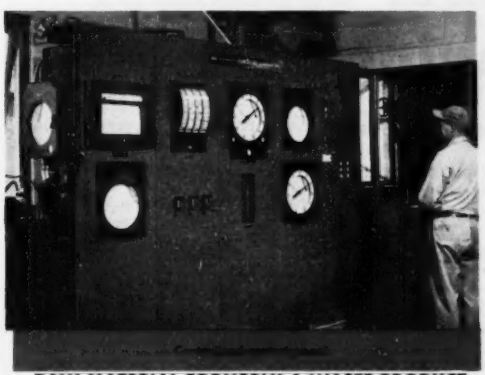
HYDROSEAL, PACKLESS AND MAXIMIX DESIGNS ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD



General view of Brown Company Reactor

First Dorrco FluoSolids* Reactor For Producing SO_2 Goes "On Stream" at Brown Company

BERLIN, N. H. In anticipation of a continuing sulfur shortage, The Brown Company at Berlin, N. H. recently installed a Dorrco FluoSolids System to produce SO_2 gas from pyrrhotite. The System at the present time is supplying the entire sulfur requirements of this sulfite pulp mill . . . 11,000 tons of sulfur equivalent per year. A producer of quality pulp for high-grade photographic papers, Brown requires clean, high-strength SO_2 gas to make their sodium sulfite cooking liquor.



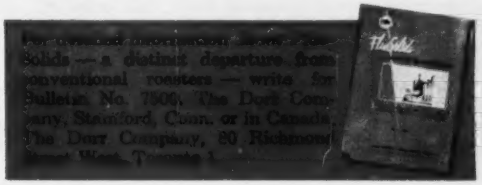
RAW MATERIAL FORMERLY A WASTE PRODUCT

The pyrrhotite, recovered from tailings of a nearby copper mine, is received in a moist condition, repulped with water to 70-75% solids, and pumped into the Reactor. By operating close to theoretical oxygen requirements, the strongest possible SO_2 gas is produced, with a black magnetite calcine which is quenched and handled in slurry form. Roast is accomplished in a 16' inside diameter Reactor with the temperature automatically held at 1650°F.

HIGH STRENGTH SO_2 PRODUCED

Gas strength at the top of the Reactor averages 13% SO_2. The gas then passes through a two-stage cyclone system followed by a cooling-scrubbing tower before going to the acid towers. Average chemical analysis of feed and calcine follows:

	Total Sulfur	Sulfide Sulfur	Total Fe
Pyrrhotite Feed	35.7	35.6	49.1
Combined Calcine	0.51	0.49	60.9



Solids — a distinct departure from conventional roasters — write for Bulletin No. 7506, The Dorr Company, Stamford, Conn. or in Canada, The Dorr Company, 80 Richmond

* Trademark Reg. U. S. Pat. Off.

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

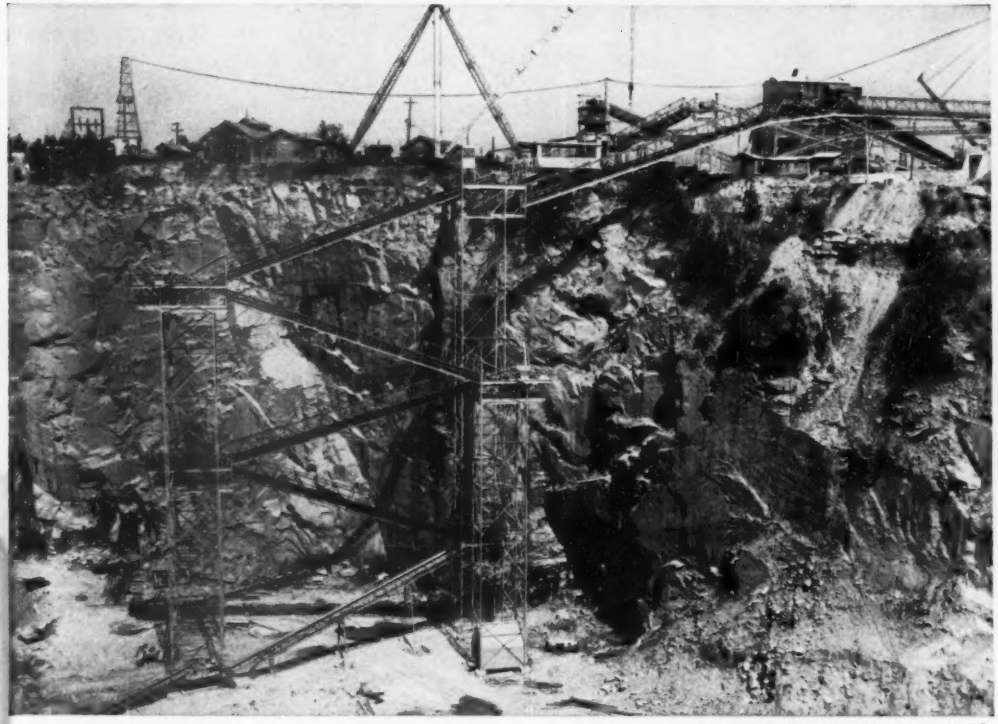


Photo courtesy The Weston & Brooker Company, Columbia, S. C.

Rocks ride rubber escalator to cut conveying costs

B. F. Goodrich conveyor belts solve rock-handling problem

CRUSHED rock used to be hauled out of this quarry in metal "pans" attached to a moving cable. But it was slow, costly, apt to break down.

Then engineers from the quarry company, working with B. F. Goodrich, designed the unusual conveyor belt system you see in the picture — five rubber escalators. Moving belts carry rock to the bottom belt in the staircase which dumps it onto the next and so on, up to the top — a distance of 268 feet. Today the B. F. Goodrich belts haul 400 tons an hour out of the quarry — 2½ times as much as before — without a moment's trouble or delay.

But the first belt in the series was a special problem. B. F. Goodrich engineers knew no ordinary belt would do because of the heavy impact when the rocks fall on it. The belt recommended to handle this job was the BFG *cord* belt, made of individual reinforcing cords that run the length of the belt. Each cord is completely surrounded by rubber. No cross threads tie them together — so they are free to give as chunks of stone strike the belt. The rubber takes the shock.

B. F. Goodrich developed this cord belt years ago, and has since made many improvements that make it first choice for many really tough jobs. One such improvement is "balanced construction". Now the layers of individual cords are built into *both* the top and bottom of the belt to give even greater impact resistance. Other construction features provide for proper troughing whether belt is empty, lightly or fully loaded, and permit longer centers, higher lifts to be used.

No matter what type or size of material you have to move, there's a B. F. Goodrich conveyor belt that can do it better, for less. Your local BFG distributor can show you how these longer-lasting belts can save you money or write *The B. F. Goodrich Company, Industrial & General Products Division, Akron, Ohio.* (Available in Canada)

Conveyor Belts BY
B.F.Goodrich
RUBBER FOR INDUSTRY

ENGINEERING AND MINING JOURNAL

VOLUME 153 — 86th YEAR OF PUBLICATION — NUMBER 11

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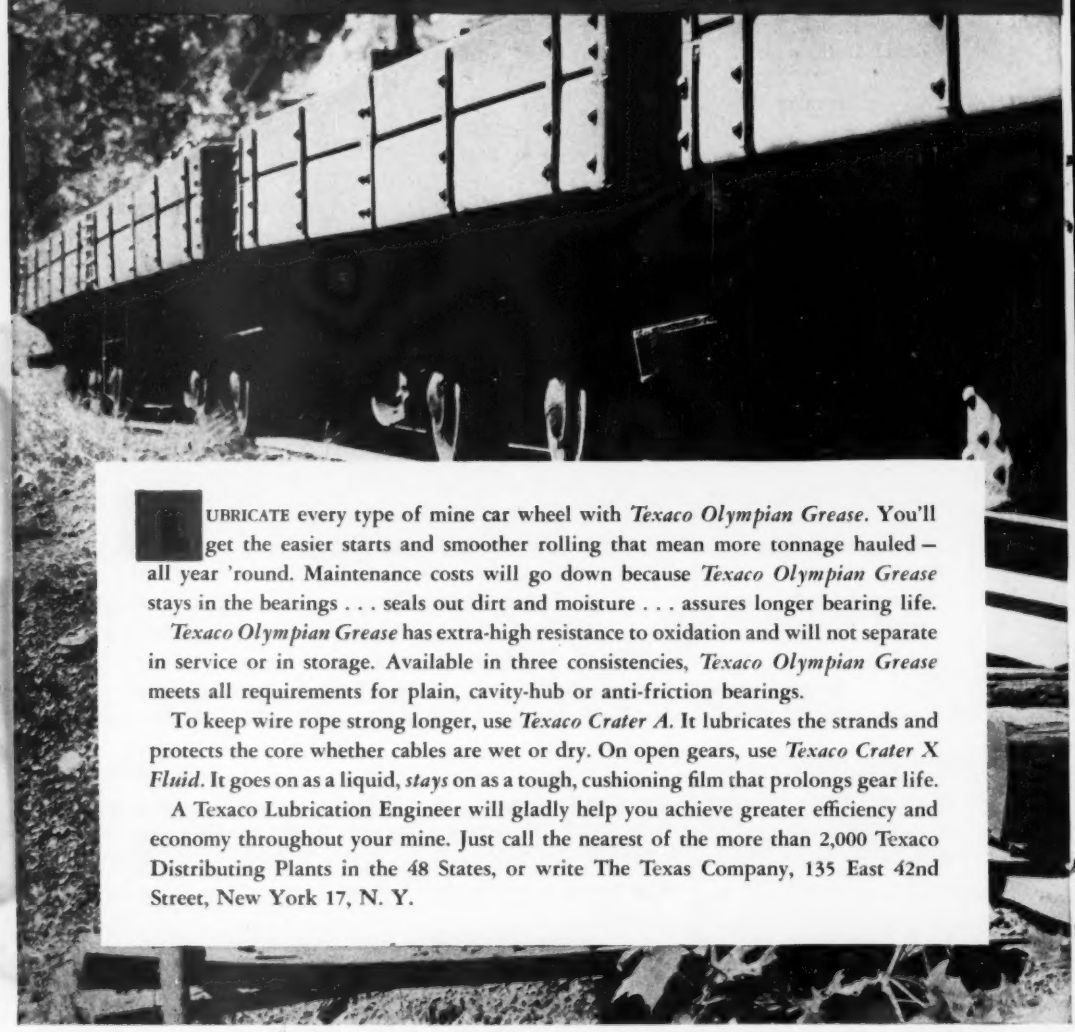
TRAINS START when you use TEXACO



LUBRICATE every type of mine car wheel with *Texaco Olympian Grease*. You'll get the easier starts and smoother rolling that mean more tonnage hauled – all year 'round. Maintenance costs will go down because *Texaco Olympian Grease* stays in the bearings . . . seals out dirt and moisture . . . assures longer bearing life.

Texaco Olympian Grease has extra-high resistance to oxidation and will not separate in service or in storage. Available in three consistencies, *Texaco Olympian Grease* meets all requirements for plain, cavity-hub or anti-friction bearings.

To keep wire rope strong longer, use *Texaco Crater A*. It lubricates the strands and protects the core whether cables are wet or dry. On open gears, use *Texaco Crater X Fluid*. It goes on as a liquid, *stays* on as a tough, cushioning film that prolongs gear life.

A Texaco Lubrication Engineer will gladly help you achieve greater efficiency and economy throughout your mine. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TUNE IN:
Tuesday nights
on television –
the TEXACO STAR THEATER
starring MILTON BERLE.

See newspaper for
time and station.

TEXACO

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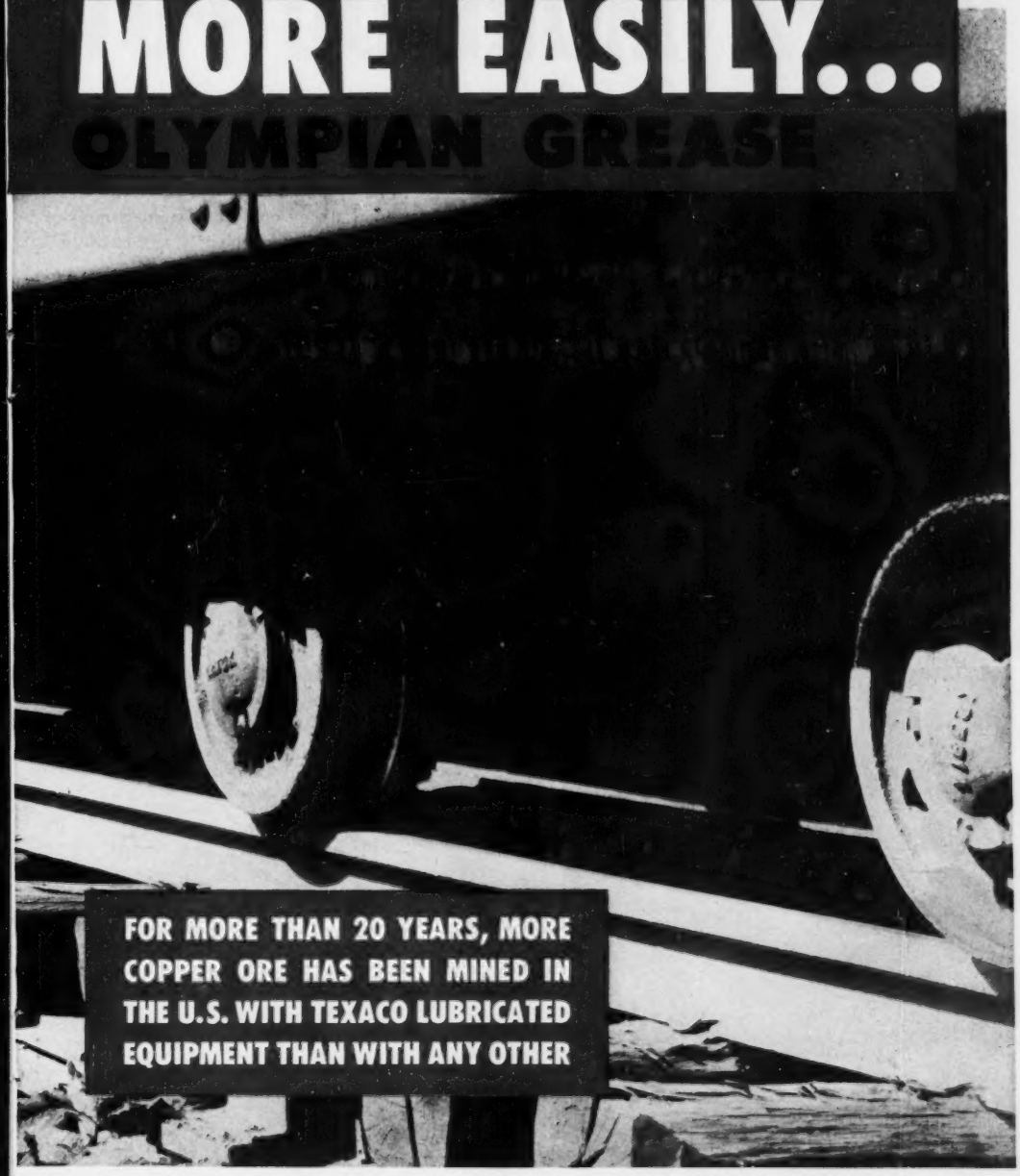
MORE EASILY...
OLYMPIAN GREASE



FOR MORE THAN 20 YEARS, MORE COPPER ORE HAS BEEN MINED IN THE U.S. WITH TEXACO LUBRICATED EQUIPMENT THAN WITH ANY OTHER

Lubricants and Fuels
FOR THE MINING INDUSTRY

Faithfully yours
50 TEXACO
for Fifty Years

9% MORE OUTPUT

By saving 15 to 25 seconds every time it dumps, Koehring heavy-duty Dumptor earns an important increase in yards hauled per hour. For example: At 16 trips an hour on a typical 1000-foot one way haul, saving an average of 20 seconds every cycle gives you 5.3 minutes more productive haul-time . . . and adds 9% to hourly yardage output.

There is no waiting for slow-acting body hoists. With Koehring gravity dump it takes just one second to dump a full 6-yard load. Operator trips the body release lever, and gravity instantly tilts the scoop-shaped body 70° . . . one second later the body is empty, and Dumptor is on its way back for another load.

You get this same one-second dumping even in sub-zero weather because gravity dump never balks . . . never wears out. And you don't lose time or spend money on expensive hoist maintenance or costly replacement parts because Koehring Dumptors have no body hoists.

One-second gravity dump and no body hoist maintenance are typical of Koehring Dumptor's basic principle . . . to reduce all non-productive time and costs to the absolute minimum . . . and to increase work-time for more yards per hour, more profit per yard for you.

Dumptor has many other cost-cutting advantages worth checking . . . it will pay you to get all the details from your Koehring distributor, or write to us for 28-page Dumptor catalog.

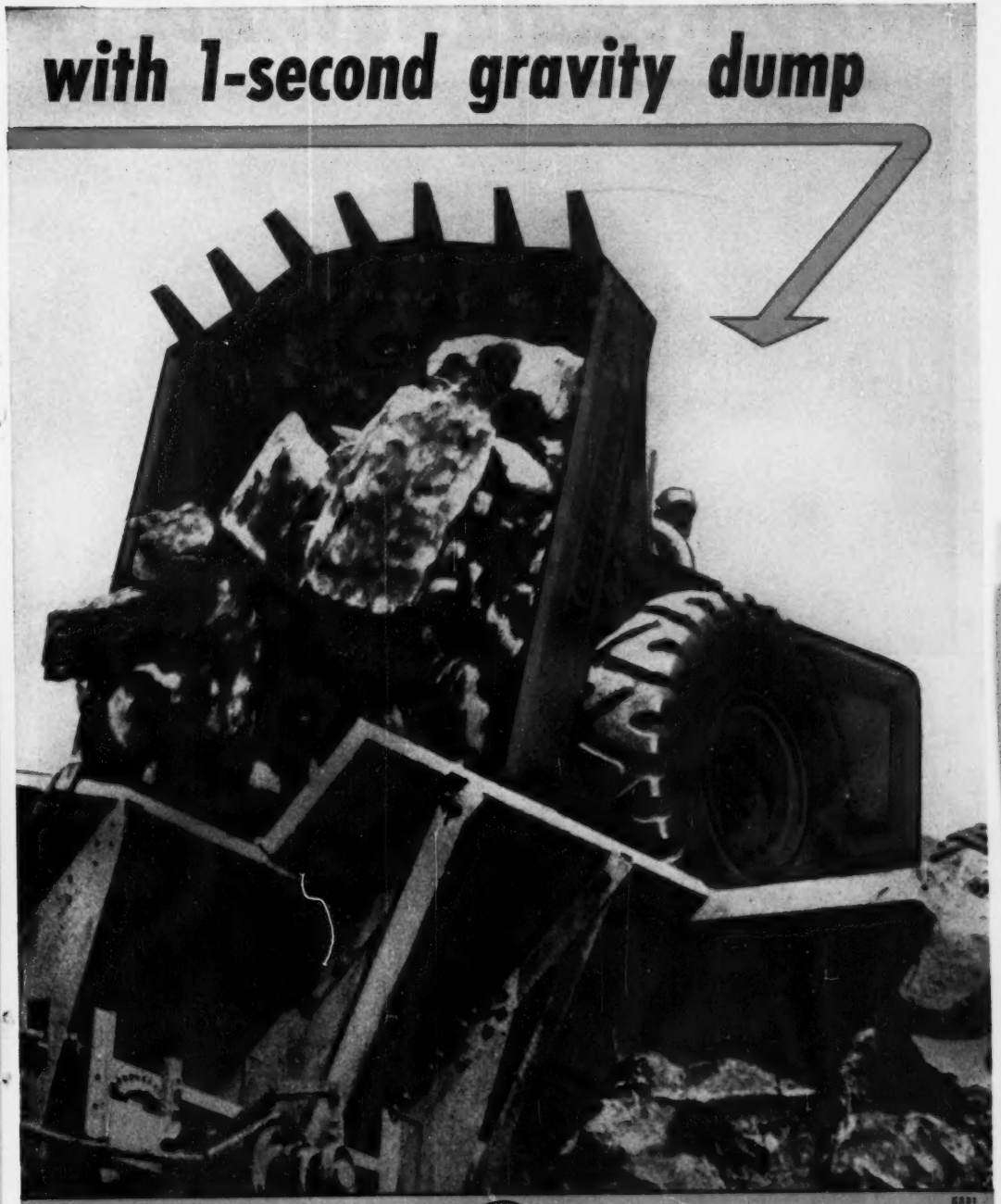
KOEHRING COMPANY • Milwaukee 16, Wis.

Subsidiaries: KWIK-MIX • PARSONS • JOHNSON

FAST CLEANING scoop-shaped body has all-welded sides, ends and bottom heavily reinforced with 4" channel ribs for toughest rock service. Triple strength is built into steel-oak-steel bottom . . . free-swinging kick-out pan adds another steel layer.

NO-TURN SHUTTLE HAUL is another production-boosting Dumptor advantage. Heavy-duty constant-mesh transmission gives the same 3 fast speeds forward and reverse . . . saves turning at the loading unit, on the haul, at the dump . . . speeds cycles.

with 1-second gravity dump

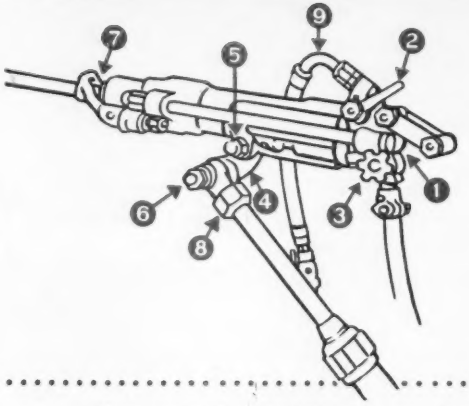


KOEHRING DUMPTOR®

EXCAVATORS . . . ⅛ TO 2½ YARDS

CRANES . . . 7¾ TO 79½ TONS LIFT CAPACITIES

ANOTHER BIG ADVANCE IN



Never before have you been offered a Jackleg drill that would do *so much—so easily*. That's because the JR-38 Jackdrill is not just an adaptation, but a completely integrated unit designed to meet your every requirement.

Since the throttle valve shuts off feed-leg air in the "off" position, the leg can be shortened or removed without even closing the feed-leg valve. Automatic air-water control avoids the need for separate adjustments. And the exclusive built-in air coupling between drill and feed leg does away with the third hose.

The JR-38 is supplied with 2′, 3′ and 4′ feed legs, and a full range of drill rotations. With a total weight of only 88 lbs. using the 3 foot feed, this is without question one of the lightest drilling units of its power ever developed.

Ask your Ingersoll-Rand representative to demonstrate the JR-38.

Here are the FEATURES you've been waiting for in a Jackleg Drill:

1. All controls grouped in fixed position on drill backhead.
2. Five-position throttle gives unified control of all operations, as follows:
   - Blowing Position – drill and air feed off
   - Off Position – drill and air feed off.
   - Feed Position—air feed on, drill off.
   - Collaring Position—automatic water and air feed on, limited air to drill.
   - Drilling Position—full air to drill and feed.
3. Feed leg control valve is built into the backhead.
4. Air connection through mounting support eliminates separate air hose to feed leg—air to leg goes through the drill.
5. Balance can be adjusted to suit operator by loosening and tightening one nut.
6. Adjustable tension on hinged joint.
7. Constant chuck blowing keeps hole free of cuttings—keeps cuttings out of drill.
8. Air feed leg easily detached by loosening one nut. Drill can be used separately as a Jackhamer.
9. Location of water connection improves balance – keeps hose out of the way.

ROCK DRILL DESIGN!

it's Ingersoll-Rand's

UNIVERSAL JACKDRILL

Use it as a **STOPER**

. . . as a **DRIFTER**

. . . as a **JACKHAMER**

The JR-38 Jackdrill is excellent as a plugger or Jackhamer. It is easily detachable from the leg by loosening one nut and ready to use without any further adjustments.

IT'S A LIGHT-WEIGHT AIR-FEED DRILLING UNIT . . . designed for faster, easier operation in any position

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11 BROADWAY, NEW YORK 4, N. Y. 814-5

You get *DOUBLE DUTY

JOY TELESCOPIC FEED STOPERS

The S-91T provides a steel change of 36", compared with the 18" change of conventional stopers. In most mining conditions, this long feed will give more drilling time, with fewer steel changes and fewer lengths to stock.

At left, the Joy S-91T Stoper in operation; above, with telescopic feed leg retracted; right, with leg extended, giving a 36" drilling feed. Another feature, instant; "thumb-flip" rotation release, provides safety and easy spotting of holes.

JOY

HAND-HELD DRILLS

A complete line of well-balanced, compact drills, ranging from 27 to 67 lbs. in weight.

The L-57 and L-67 Joy Hand-Held Drills are also available with mounting brackets for use as light drifters, or for wagon drill mounting.

Joy Jibs are hydraulically controlled booms for drill mounting on Jumbos, or on rubber-tired, self-propelled Drillmobiles.

JOY HYDRO DRILL JIB

Air-hydraulic control of all jib movements eliminates heavy lifting, and permits more accurate hole spotting for more efficient use of powder and controlled breakage.

OVER 100 YEARS OF ENGINEERING LEADERSHIP

with JOY DUAL-VALVE SILVER STREAK DRILLS

*Maximum Footage–Maximum Economy

In tunnels, crosscuts, drifts, or stopes, Joy *Silver Streak* Rock Drills with the DUAL VALVE will do your drilling job faster, and use less air with lower maintenance. Here's why—

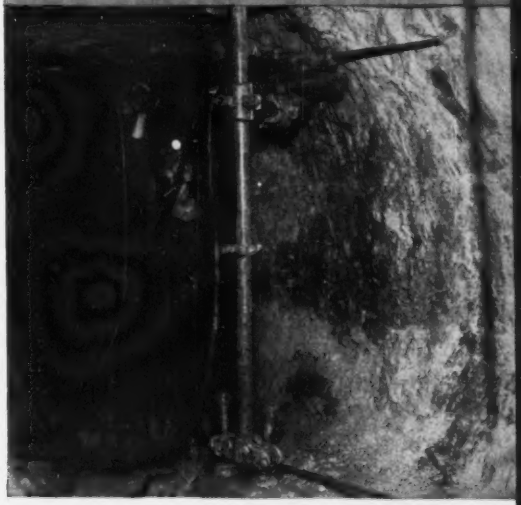
(1) The exclusive DUAL VALVE, a feature of all Joy rock drills, makes air do more work. By admitting the correct amount of air behind the piston and excluding air ahead of it during the drilling stroke, maximum force is exerted on the drill steel. There's no cushion of air ahead of the piston to reduce the force of the blow. Then the rear section of the Dual Valve meters the correct amount of air ahead of the piston to force it back with a "snappy" rotating action. This adds up to more power-packed strokes per minute, for faster drilling with less air.

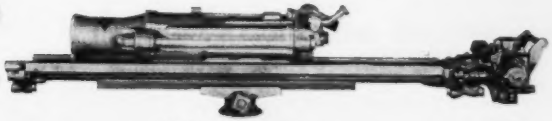
(2) The silver-like cadmium plating on Joy *Silver Streak* Rock Drills aids lubrication while running-in, protects parts from rust while in stock, and keeps maintenance costs at a minimum.

The Joy line is complete. There's a *Silver Streak* rock drill for every rock breaking need. Shown here are drifters, stopers, hand-held drills, Hydro Drill Jibs. To complete the line, there are wagon drills; the QB-20 for line drilling and dimension stone quarries; rubber-tired, self-propelled Drillmobiles; and specially mounted drills for special needs.
● ***Let our Field Men work with you.***

JOY DUAL VALVE

"Makes Air do More Work"





JOY DRIFTERS

For column mounting, as at right, or for use on mobile jumbo units, Joy Drifters are built in three sizes—all with fast, powerful Dual Valve action. Efficient Pistonmotor Feed, with only two moving parts, provides strong, steady advancement and retraction. One-piece locking chuck increases bearing area and reduces wear on lock ring and chuck bushing.

Consult a Joy Engineer

WAD 3702

JOY MANUFACTURING COMPANY

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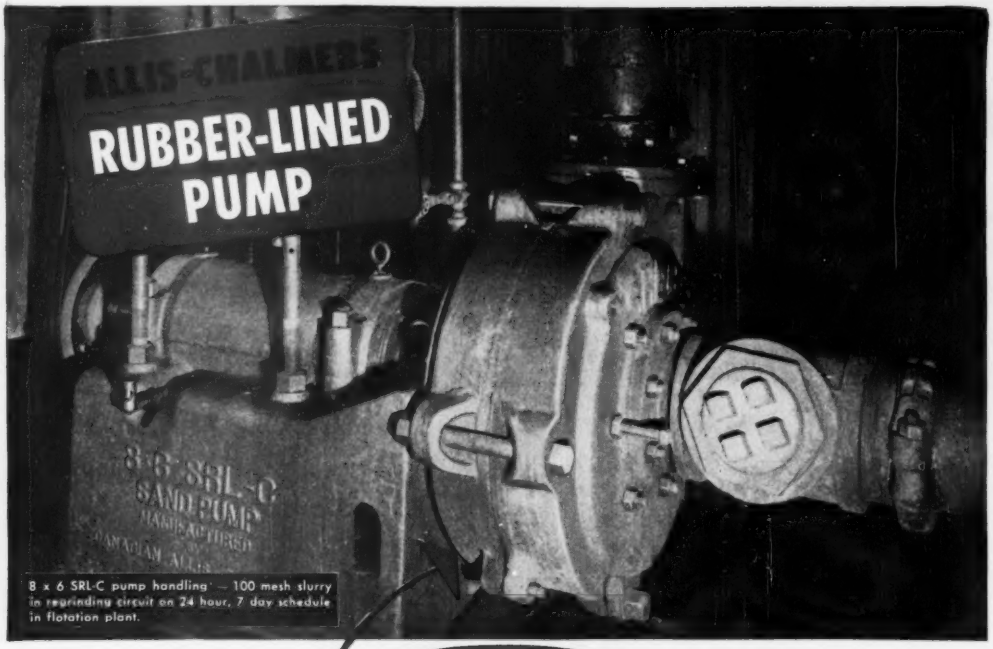


8 x 6 SRL-C pump handling — 100 mesh slurry in regrinding circuit on 24 hour, 7 day schedule in flotation plant.

Here's How THIS PUMP Cuts Slurry and Slime Pumping Costs

SPECIAL RUBBER COMPOUNDS, engineered to fit each application, resist wear of even the most abrasive slurries and slimes. Original capacity and efficiency are maintained over long periods. Records show that the Allis-Chalmers rubber-lined pump has a service life 10 to 50 times greater than the finest alloy pumps when handling finely divided, highly abrasive materials. This means that the higher price of the rubber-lined pump is saved many times over in lower maintenance cost and less lost production due to shutdowns. The stuffing box, too, is specially designed to reduce packing wear.

EASY MAINTENANCE

Maintenance on the Allis-Chalmers rubber-lined pump is easy. All parts normally requiring attention are accessible for inspection, adjustment or replacement. The casing can be parted easily when impeller and liners must be checked. The stuffing box is easy to work on.

The casing liners are of unique construction. The rubber compound is pressure-molded to steel frames. The liners fit into casing easily and are held securely in place by studs which are part of the steel frame and are securely embedded in the rubber. Liners and the impeller can be renewed without removing the pump from its location and spares can be kept on hand.

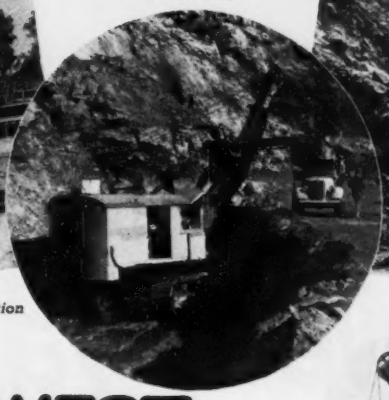
COMPETENT APPLICATION ENGINEERING

Allis-Chalmers application engineers are thoroughly familiar with all types of solids pumping problems. Allis-Chalmers can furnish you a complete pumping unit — pump, motor, control and drive — all of coordinated design and manufacture. For help on your solids pumping problems, call your nearest Allis-Chalmers District Office. For more information on the A-C Rubber-Lined Pump, write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 08B7311.

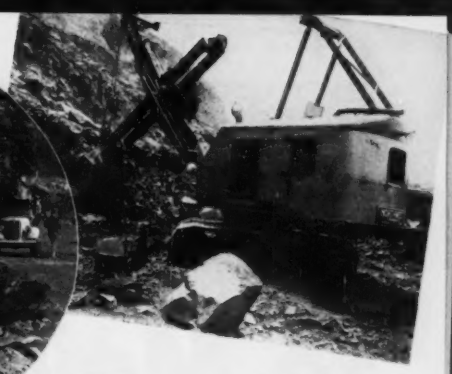
A-3897

ALLIS-CHALMERS

Iron mining operation in Texas



Handling iron ore on the Range



It's another

NORTHWEST

Everywhere in Mining

● Iron, Copper, Zinc, Bauxite, Asbestos, Gold, Silver—what do you mine? There are Northwests in every type of digging from Republic Steel Company's operation at Lyon Mountain, N. Y., to Kennicott Copper in Utah.

Northwests bring you steering advantages, operating advantages and low-cost ease of maintenance that makes them highly profitable in mining. This is not an advertising claim. It is backed by years of performance and can be proved to your satisfaction. Plan ahead now. Talk to a Northwest man and get complete information.

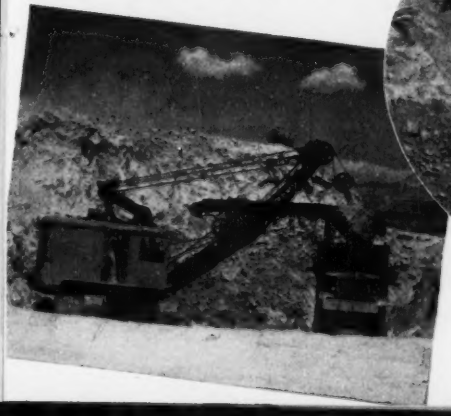
NORTHWEST ENGINEERING COMPANY
1509 Field Building, 135 South La Salle Street, Chicago 3. Illinois

SHOVELS CRANES
DRAGLINES
PULLSHOVELS

Another iron mine in New York State

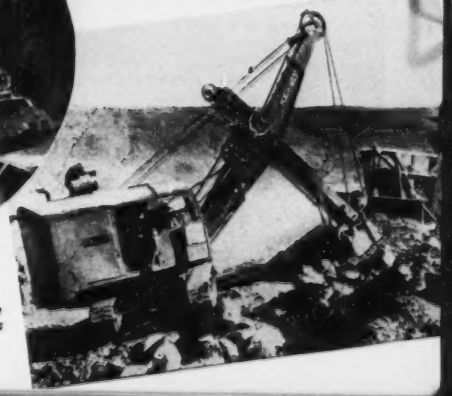
Taking out vermiculite in Montana

Feeding a gold washer in California



Taking out zinc ore

Mining bauxite



One of the large copper operations in the West

What Does it Cost to Move a Yard of Earth?

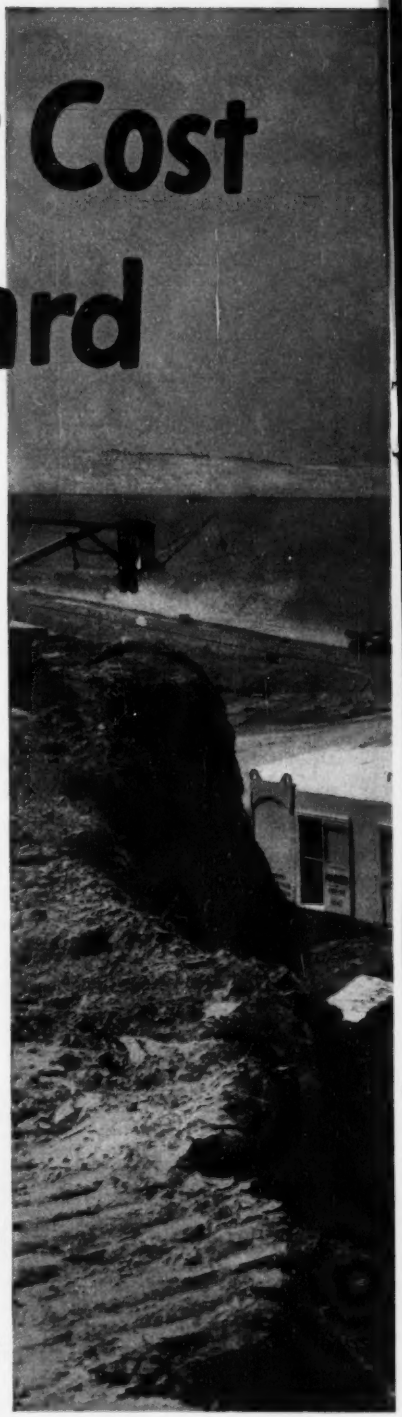
Three MARION 191-M shovels are handling the excavation work for two giant dams on the Missouri River. Their records in soil, clay, shale and rock are making excavating history that will be significant in heavy construction and mining.

Big dipper capacity, tremendous power and real speed (18-second cycle time—as fast as your smallest machine) make the MARION 191-M an outstanding performer where big yardages are needed. What is the cost of moving a yard of dirt, rock or ore? The 191-M provides new and interesting answers. Write for the details.

MARION POWER SHOVEL COMPANY

Marion, Ohio, U. S. A. • from ¾ cu. yd. to 45 cu. yds.

Offices in Principal Cities Throughout the World

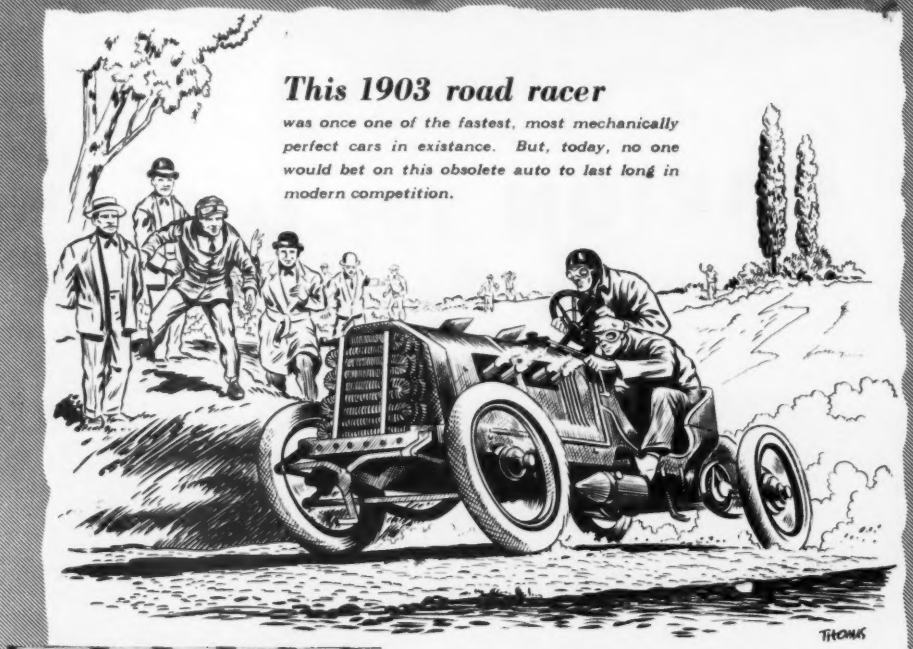


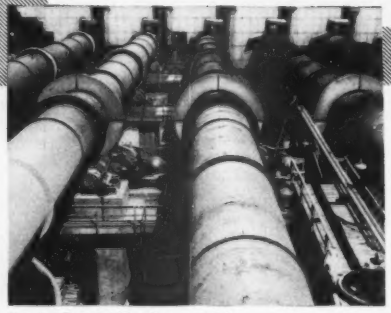
MARION 191-M, the world's largest loading shovel, at Ft. Randall Dam.

MARION 191-M
Provides New Answers!

This 1903 road racer

was once one of the fastest, most mechanically perfect cars in existance. But, today, no one would bet on this obsolete auto to last long in modern competition.





Traylor Rotary Kilns have earned a world-wide reputation for boosting the production of a uniform, high-quality product. Each kiln is specially designed to fit its job. For complete information, ask for Bulletin 115.

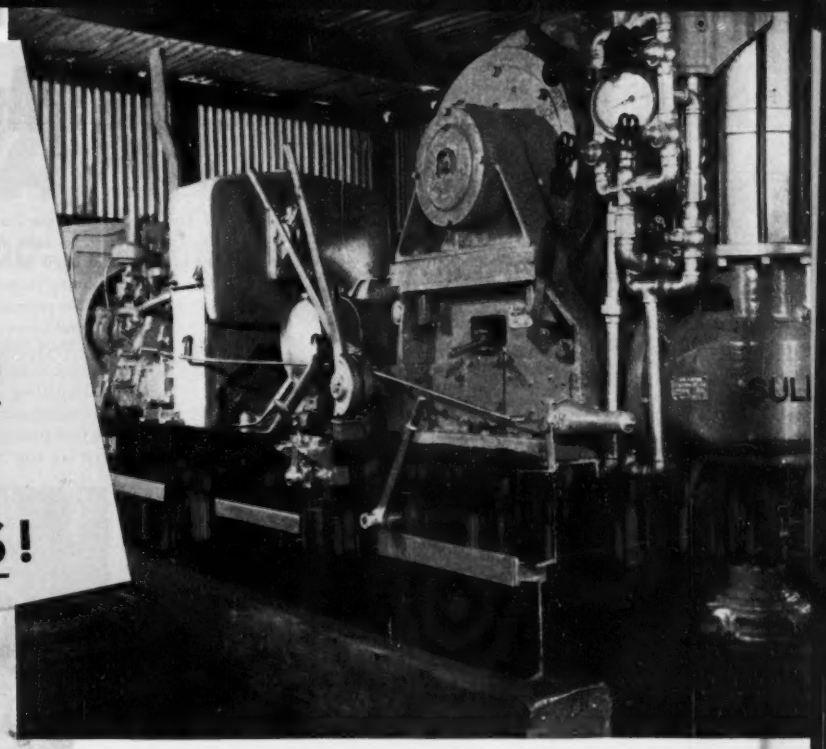
NEITHER CAN MINING MEN gamble on obsolete equipment in the constant race between greater production and increasing costs. For 50 years, Traylor has worked with the mining industry . . . always developing better machinery to give production a comfortable lead over costs. It takes experience to build equipment that can stand the pace of progress in these fast moving times. Traylor has experience . . . half a century of it.

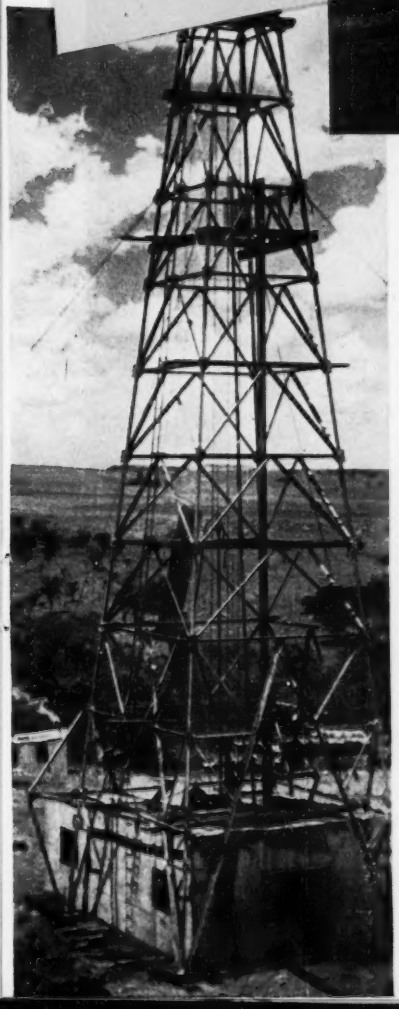
OUR GOLDEN ANNIVERSARY YEAR 1902 1952

TRAYLOR ENGINEERING & MANUFACTURING COMPANY
1462 MILL ST., ALLENTOWN, PA.
SALES OFFICES: New York • Chicago • San Francisco
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P. Q.

a **Traylor** *leads to greater profits*

"OLD FAITHFUL" HAS EARNED ITS NAME WITH OVER 110,000 WORK HOURS!





In September, 1934, the Diamond Drilling Co. of South Africa Ltd. purchased a "Caterpillar" Diesel D7700 Engine to power a gold drilling rig. With the exception of two years during the war, this engine has operated 24 hours a day, six days a week, rolling up more than 110,000 hours of operation.

During its long life, new pistons and liners have been installed three times. Other repairs include new fuel pumps and injection valves and one new set of connecting rod bearings. The total cost of repairs and labor has averaged less than 1½ cents per work hour.

The D7700, affectionately known as "Old Faithful," drives a Sullivan diamond drill which probes the earth in a search for gold reefs. Several holes have been driven to depths of over two miles.

The Diamond Drilling Co. has continued to replace steam-driven rigs with "Caterpillar" power and now has 17 "Cat" Engines at work. T. B. Haines, District Foreman, says the firm has gone 100% "Caterpillar" because of low maintenance cost, reduced labor costs, and savings in the costs of fuel.

Those same reasons hold good wherever mining operations call for dependable power. Your "Caterpillar" Dealer can give you many additional facts about these sturdy engines for your mining jobs. See him today.

CATERPILLAR, PEORIA, ILLINOIS

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL ENGINES
TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT

How to Reduce Roof-Fall Accidents

You can minimize the chances of roof-fall accidents, making your mine safer and more productive, by using Bethlehem Roof Bolts in place of old-fashioned, space-consuming supports.

Bethlehem Roof Bolts promote safety because they tend to consolidate several layers of roof strata into a single-unit, thick beam. They also offer these other advantages: (1) increased economy, (2) faster transportation, (3) less material-handling, (4) wider mine openings, and (5) improved ventilation.

Bethlehem Roof Bolts are furnished in two types, each one designed to meet certain conditions. The bolts come in a wide variety of lengths, and can be used vertically or at angles. For full information write to us at Bethlehem, Pa.

◀ BETHLEHEM SQUARE-HEAD BOLT
(With Expansion Shell)

This assembly consists of unchamfered square-head rolled-thread ¾-in. bolt, plug, and expansion shell. Bolt shank has two pressed ears, to support shell during anchoring. Plug is forced into shell when bolt is tightened, expanding leaves of shell to provide proper holding-tension. Leaves have sharp projections which contact sides of the hole, to prevent shell from turning when bolt is rotated.

BETHLEHEM SLOTTED BOLT ▶

Has forged slot to accommodate wedge. The slot is centered by an exclusive process which forms the equivalent of two half-rounds. Other end of bolt has 5 in. of 1-in. rolled threads. When driven against back of hole, wedge is forced deep into slot, expanding bolt-ends to provide tight grip. Truncated-cone point helps prevent thread damage. Comes with American Standard Regular Square Nut.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM MINE ROOF BOLTS

6 YEARS' SERVICE-

3,500,000-plus tons *and still going strong!*

When the G.T.M.—Goodyear Technical Man—was called in to specify a conveyor belt for this asphalt mixing plant, wartime demand prevented redesign of the loader to eliminate too-close clearance which was grinding sharp, abrasive rock into the belt.

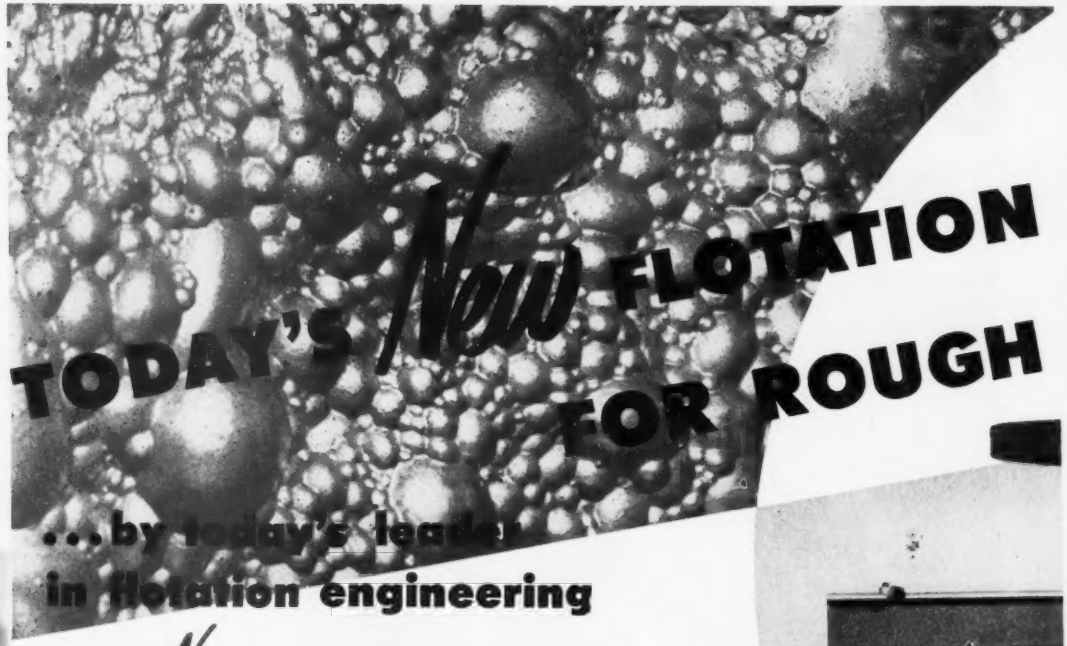
In spite of the belt-killing abrasion, the Goodyear Style B conveyor belt he installed has been going strong in service which would have quickly destroyed most belts—more proof that Goodyear's design-for-the-job means outstanding conveyor belt service.

LOOK FOR YOUR GOODYEAR INDUSTRIAL RUBBER PRODUCTS DISTRIBUTOR *in the yellow pages of your Telephone Directory under "Rubber Products" or "Rubber Goods." He handles Hose, Flat Belts, V-Belts, Molded Goods, Packing, Tank Lining, Rubber-Covered Rolls built to the world's highest standard of quality.*

We think you'll like "THE GREATEST STORY EVER TOLD" Every Sunday — ABC Network

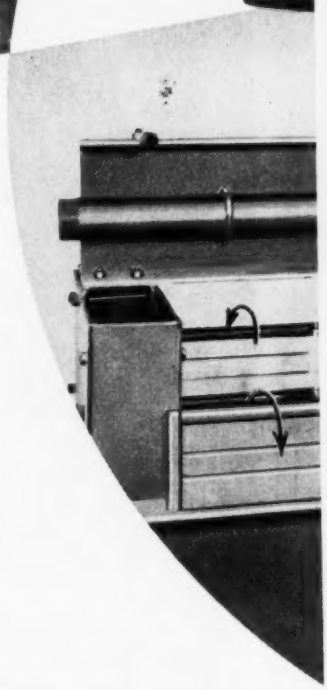
GOODYEAR

THE GREATEST NAME IN RUBBER



TODAY'S *New* FLOTATION FOR ROUGH

. . . by today's leader in flotation engineering



New Denver "Sub-A" Super-Rougher Flotation Machine gets you more values from roughing and scavenging circuits

You get more profits from your ore with the NEW Denver "Sub-A" Super-Rougher Flotation Machine—developed especially for low-grade ores. Yesterday's tailings may be today's profits, because of the price of metal. The Denver "Sub-A" Super-Rougher Flotation Machine is designed to get these extra profits out of your scavenging and roughing circuits!

This Denver "Sub-A" Super-Rougher Flotation Machine gives you the intense aeration necessary to get the most values from your roughing and scavenging circuits.

Controlled feed to the agitation chamber, supercharged aeration, an adjustable sand relief opening, and controlled pulp level give the flexibility in this low level, double overflow flotation machine that your flotation engineer *must* have for maximum results and profits.

Phone, write or wire today for more information! Find out how you can reduce tailings values and increase your mill efficiency by using Denver "Sub-A" Flotation—the world's leading manufacturer of flotation machines.

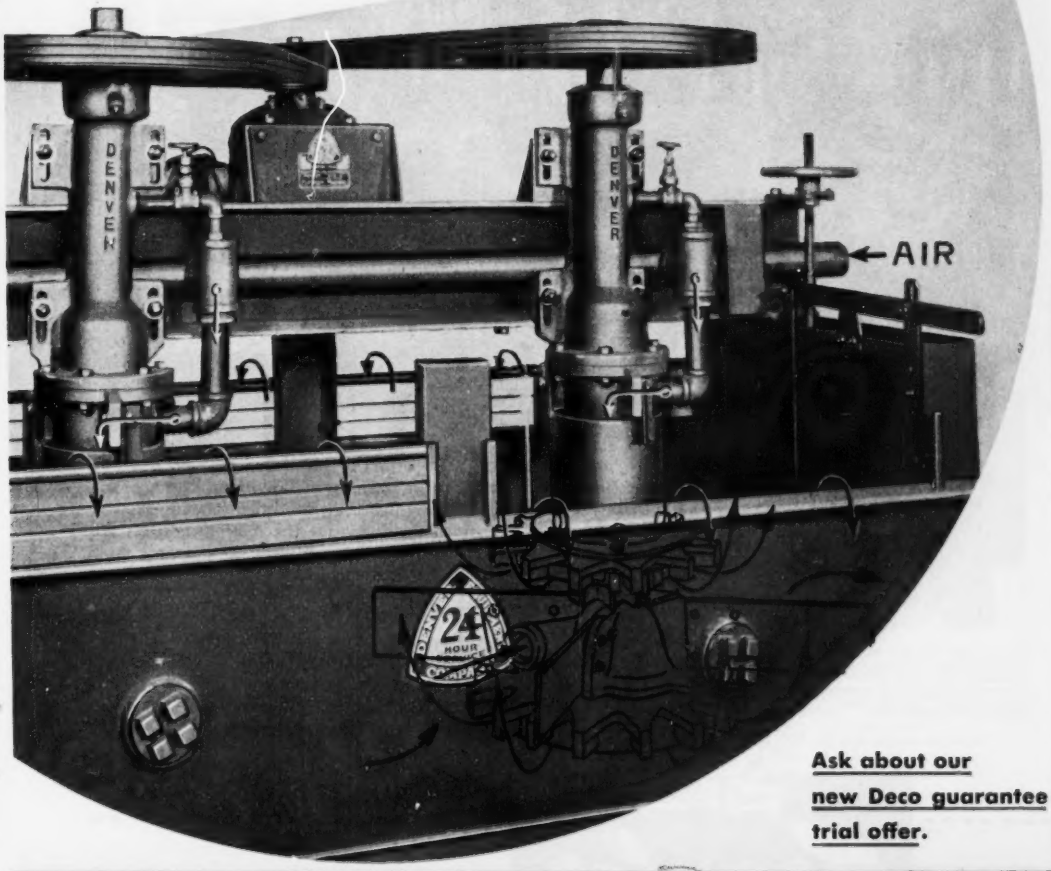
Patented and Patents Pending

DENVER

DECO FLOTATION ENGINEERS — DENVER EQUIPMENT COMPANY — 24 HOUR SERVICE

OUR 25TH YEAR OF FLOTATION ENGINEERING

MACHINE
ING AND SCAVENGING!



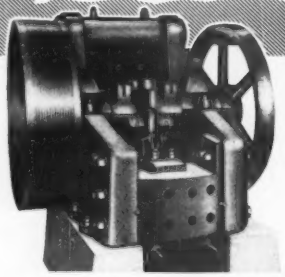
Ask about our new Deco guarantee trial offer.

EQUIPMENT COMPANY

4400 17th Street, Denver 17, Colorado

"Wet or dry," . . .

ore could be crushed by this ancient machine. But workmen had to process the same ore many times before they got a uniform product "smaller than a hazel nut."



Developing equipment to do the job right the first time . . . at modern rates of production . . . is the business of Traylor engineers. For 50 years, Traylor has been doing just that, continually building better, more advanced crushing machinery for the mining industry. It takes experience to design machines that meet the growing demands of an exacting industry. Traylor has experience . . . half a century of it.

Traylor Type S Jaw Crushers include Traylor's exclusive non-chokable, curved jaw plates for greater capacity at finer setting. Bulletin Type 125 gives specifications and description.

OUR GOLDEN ANNIVERSARY YEAR

1902 IN 1952

TRAYLOR ENGINEERING & MANUFACTURING COMPANY

1452 MILL ST., ALLENTOWN, PA.

SALES OFFICES: New York • Chicago • San Francisco

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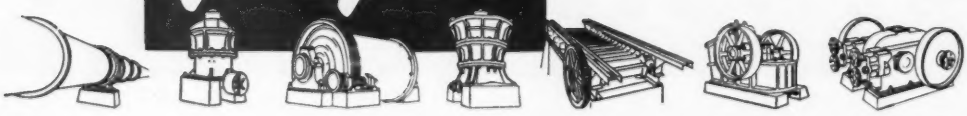
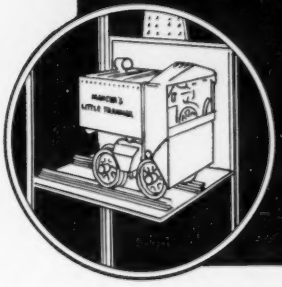
a **Traylor** *leads to greater profits*



Mighty midget with a king-size production record!

MANCHA'S LITTLE TRAMMER



TRAMMER, WITH CAB RAISED, ON CAGE FOR TRANSFER TO ANOTHER LEVEL

Operating weight, 1½ tons

For haulage duty . . . for moving mucking machines and drill jumbos . . . timber and supplies . . . or man trips to distant workings, Mancha's Little Trammer is the choice of mine operators everywhere.

If you'd see one of these powerful little locomotives in action, you'd see why. It's rugged and safe. It's small enough for work in narrow, crooked drifts, and easily transported from level to level. Climate, altitude and poor ventilation cannot slow it down. Maintenance cost is surprisingly low. Quite likely a Mancha's Little Trammer will more than pay its own way in your mine operations. Write for our mine haulage Data-Form and find out. There's no obligation on your part.

Mancha Storage Battery Locomotive
Division **GOODMAN** *Manufacturing Company*
4850 South Halsted Street, Chicago 9, Ill., U.S.A.
E AND MJ 1152
Send your mine haulage data form.

NAME _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

MANCHA STORAGE BATTERY LOCOMOTIVE
Division **GOODMAN** *Manufacturing Company*
4850 SOUTH HALSTED STREET CHICAGO 9, ILL., U. S. A.

Hauls 82,476 tons of

Dunn Limestone Company, Inc.

Pulverized Limestone Products
Spencer, Indiana

STATEMENT OF HAULING OPERATIONS

Period: 6 months, May through October
Haul Units: Two 9-ton rear-dump LeTourneau Tournarockers

MATERIAL MOVED DURING PERIOD

Rock	79,923 tons	
Limestone	2,493 tons	
Fluxing Stone	60 tons	
TOTAL AMOUNT		82,476 tons

OPERATING COSTS

Operaters' Wages	$2,759.54	
Fuel	375.62	
Lubricants, etc.	130.06	
Cable	5.00	
Repairs (Batteries and Filter)	164.25	
Insurance, Interest and Taxes	528.48	
Depreciation	3,270.90	
TOTAL COSTS		$7,233.85

Total hours charged for period	1932.0	
Less stripping, painting time	250.5	
TOTAL TIME CHARGED TO HAULING		1681.5 hours

BREAKDOWN OF COSTS

$7,233.85 total costs / 1932 hours gross time = $3.744 Cost per hour

1681.5 net hauling hours x $3.744 cost per hour = $6,295.54 total hauling costs

$6,295.54 total hauling costs / 82,476 total tons moved = $0.0763 Hauling cost per ton

HAULING PRODUCTION TIME STUDY

Period: 6 months, May through October
Haul Units: Two 9-ton rear-dump LeTourneau Tournarockers

TIME RECORD		
Total hours charged for period		1,932
Less Stripping Time	250.5	
Less Greasing and Servicing Time	81.5	
TOTAL HAULING HOURS		1,600

MATERIAL MOVED BY HAULERS

Material	Direction	No. of Loads	No. of Tons
Rock	From Quarry to Crusher	7,477	79,923
Limestone	From Plant to Railroad	247	2,493
Fluxing Stone	From Plant to Railroad	6	60
TOTAL MOVED DURING PERIOD		7,730	82,476

7,730 loads / 1600 hours = 4.83 loads per hour per unit

82,476 tons / 1600 hours = 51.54 tons per hour per unit

FUEL CONSUMPTION

Total fuel used during period		2,573 gallons
Total Hours Charged	1,932	
Less Greasing and Servicing Time	81.5	
ACTUAL RUNNING TIME		1,850.5 hours

2,573 gallons / 1,850.5 hours = 1.39 gallons per hour

DESCRIPTION OF OPERATIONS

Approximately 70% of material hauled 3500 ft. from quarry to crushing plant. Average load, 10½ tons, with loading done by ¾-yd. shovel.

"Tournarockers have plenty of power to carry any load we place on them," says Operator Gerald R. Summuldt. "I like them very much." Big 4-wheel multi-disc air brakes add confidence for safe, fast hauls.

Load is dumped at crusher. Occasionally, rig also hauls finished product to railroad cars which are along line of haul from quarry to mill. Operator Summuldt says, "Tournarockers are easy to handle — especially in these close places — due to their short turning radius."

rock at 7.6c per ton

Dunn Limestone Co. averages 103 tons hourly over 6-month period with two 9-ton Tournarockers

Cost and production records are "proof of the pudding" as far as Dunn Limestone Company, Inc. of Spencer, Indiana, is concerned. Formerly, all their rock was hauled from quarry to crushing plant by 1½-ton trucks. Early in 1951 the trucks were replaced with 2 electric-control, rear-dump 9-ton D Tournarockers, with the following "very satisfactory" results (as based on the company's own figures over a 6-month period):

Loaded by a ¾-yd. shovel at the quarry, each high-speed "Rocker" moved 10⅔ tons of blasted quarry-run rock to the crusher every 12 minutes. Rigs made 4.8 trips per hour over a 7000′ cycle . . . also handled some haul-back of limestone and crushed rock to rail cars. In 1,600 hauling hours, the 2 Tournarockers delivered a total of 82,476 tons (7,730 loads), for an average of 51½ tons per hour per unit.

Over 1,932 total operating hours, total costs (including operator wages, fuel, oil, repairs, insurance, interest, taxes and depreciation) averaged $3.74 per hour . . . or *7.63c per ton of rock hauled.* No wonder Company Vice-President John D. Beem says, "These actual operating figures over a six months' period convinced us that Tournarockers are handling our job on a very satisfactory basis!"

On 7000′ cycle, rig averages 15 m.p.h., often hits top of 28 m.p.h. "These rigs do our job perfectly," says Foreman Elduth Lacy, "I wouldn't trade them for any other hauling units on the market today."

Whenever *you* have rock, dirt, or ore to haul, it will pay you to investigate the savings possible with Tournarockers. There's a size to fit your needs . . . 9, 18, 35 and 50 tons. See your LeTourneau Distributor for full details.

Tournarocker is loaded with 10 to 11 tons of pit-run rock in an average of 7½ minutes.

Tournarocker—Trademark Reg. U. S. Pat. Off. DR-146-Q

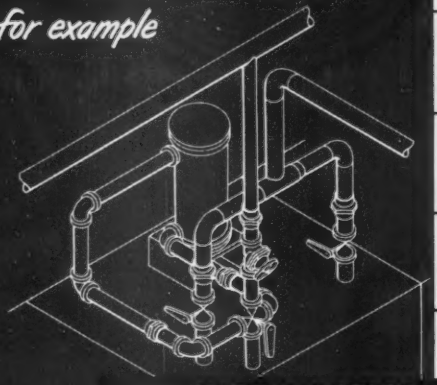
R. G. LeTOURNEAU, INC.

Peoria, Illinois

LETOURNEAU LET EQUIPMENT

Are Your Valves Behaving This Well?

...on River Water, for example



THE INSTALLATION

Crane Iron Body Diaphragm Valves on hydraulic lines to cylinder operators on ash pit gates; Southwark Station; Philadelphia Electric Company.

VALVE SERVICE RATINGS

SUITABILITY: Good design for gritty fluid

FEATURES: Neoprene disc insert-resists cutting

MAINTENANCE COST: Making big savings here

SERVICE LIFE: Already 6 to 9 times longer than other valves

CORROSION-RESISTANCE: O.K. no sign of corrosion

PRICE: Better than many ordinary valves

AVAILABILITY: Regular number in Crane line

THE HISTORY

Valves were installed in the hydraulic system when the control cocks failed to shut off tight. But like the cocks, conventional valves put in this service didn't stand up. They couldn't handle the abrasive, sandy river water used for hydraulic operators as well as for ash pit sluicing. They leaked badly in 3 to 5 weeks; had to be replaced.

The problem was solved with Crane Iron Body Diaphragm Valves. Installed more than 7 months, there's been no leakage since; no valve trouble of any kind. The Neoprene disc insert and wide, flat seating surfaces in Crane Valves show no effect of abrasion. Their completely sealed bonnet keeps working parts free of grit.

THE VALVE

In Crane Packless Iron Body Diaphragm Valves, the Neoprene diaphragm acts as bonnet seal only; is not subject to crushing and rapid wear. Separate disc with Neoprene insert shuts off flow even should diaphragm fail. Made unlined or with full Neoprene body lining. Well suited for erosive fluids, sludges, slurries; also for many corrosive services. See your Crane Catalog or call your Crane Representative.

The Complete Crane Line Meets All Valve Needs. That's Why

More Crane Valves Are Used Than Any Other Make!

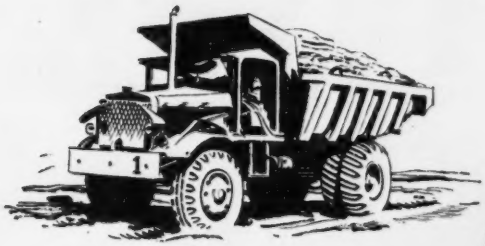
CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

MUSCLE MAN
for tire-killing jobs



THIS burly giant pulls through rough going that other tires find hard to take. Massive lug-bars armor its underbody and sidewalls—shrug off stones, stumps, snags and potholes. Extra thick, self-cleaning treads shield its extra thick plies—give you better traction, *full pull*, forward or reverse. A sturdy standby is this super-tough Goodyear—the Hard Rock Lug. Wherever the going is really rugged, it can save you time and money—perhaps the job itself!

HARD ROCK LUG
Super-tough champ in all types of tire-killing work.

HARD ROCK RIB
Companion tire for front wheels in all tire-killing service. Easier steering, smooth rolling, same cord body, same shoulder and sidewall as the Hard Rock Lug.

ROAD LUG
This high-stamina, dual-purpose tire is best for trucks that operate both OFF and ON the road. Tough construction and special tread design provide super-traction off the road—long, smooth mileage on the road.

FOR EVERY JOB, THERE'S A COST-CUTTING GOODYEAR TIRE!

Road Lug—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

Possible applications for FIBERFRAX fiber

THERMAL INSULATION

- Used loose, bonded, packed, or as a blanket for insulating furnaces, jet engines, etc.
- Tape for wrapping pipes and other parts requiring high temperature insulation.
- Fireproofing for safes and containers.
- Packing for expansion joints, kiln cars, etc.
- As a paper, fire curtain, or bonded into a fire wall.

REINFORCING AGENT

- To reinforce electrical insulators, battery plates, etc.
- As a base for sprayed-on ceramic coatings.
- With resins to produce fiber-plastic materials.
- With deposited metals to make porous structures.
- In brake linings.

AS A FILTER

- To filter gases (can be burned clean and reused).
- Filtration of liquids (oils, acids, etc.).
- Flame filter to remove ash (as in gas turbine).

MISCELLANEOUS

- As a wick or other capillary body.
- Cushioning or vibration dampening material.
- Bonded into acoustical tiles.
- As a diffusing material (high corrosion resistance).
- As a catalyst support.
- For dielectric materials.

This listing does not represent all possible uses. These are simply suggested applications, many of which are untried.

versatile ceramic fiber — insulates, makes superfine filter, resists 2300°F (and more)

This cotton-like material is a ceramic fiber, a new synthetic with a host of interesting possibilities. Brand new, this remarkable fiber (trademarked FIBERFRAX) easily withstands 2300 F without loss of properties, and up to 3000 F without melting — temperatures far higher than possible with existing mineral or glass fibers. Applications already tested range from — use as a superfine filter (even fine enough to filter bacteria) — to insulating blankets for combustion and exhaust systems of jet engines — to dielectric papers (with electrical losses ¼ those of Kraft paper).

FIBERFRAX fiber is made by melting aluminum oxide and silica (both non-critical materials) at 3300 F. The molten mix is then poured and blasted with an air jet. Instantly, a mass of fluffy white fibers is formed. These fibers are as long as 3", yet average only 4 microns in diameter (about 1/25 the diameter of a human hair). Weight, as blown, is just 2 lbs per cu ft.

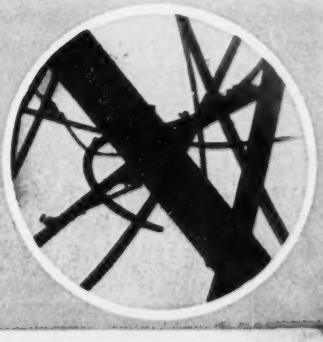
This random mass of fibers has many talents. Experimentally, it has been bonded into batts, made into felted rolls or blankets, and even made in paperlike forms (such as tape). When packed to density of about 6 lbs per cu ft, it can make a better heat insulator for many furnaces than high grade insulating brick. Because of its pronounced capillary qualities, it seems suitable for use as a wick. FIBERFRAX fiber is also virtually impervious to most acids. It could be used as a catalyst carrier. And it seems a natural substitute for asbestos — or it could be combined with this rather critical material.

Inherently an excellent electrical insulator, FIBERFRAX fiber will find many dielectric applications. It also lends itself to use as a reinforcing agent — for example, in battery plates, or in low pressure laminates, or perhaps as a base for sprayed on ceramics. It is resilient and makes a good cushioning or packing material, particularly for high temperature spots. It could be used for fire proofing, or bonded into a firewall. FIBERFRAX tiles also deaden sounds. In bulk or paper form it makes an unparalleled filter for gases, liquids, flames, etc.

Do any of these applications suggest possibilities to you? If so, please write or phone us. Though FIBERFRAX fiber is presently available only in bulk form, all the forms mentioned here (and perhaps others) will soon be commercially available. Why not check up now?

CARBORUNDUM
Trade Mark

"Carborundum" and "Fiberfrax" are trademarks which indicate manufacture by The Carborundum Company



FIBERFRAX material magnified 500 times. Note the diverse size and random arrangement of fibers (ideal properties for a filter material).

FOR COMPLETE INFORMATION — USE THIS COUPON

Dept. U-112, Refractories Division
The Carborundum Co., Perth Amboy, N. J.

Please send free folder on FIBERFRAX fiber.

Name_____

Position_____ Company_____

Street_____

City_____ Zone____ State_____

WHEN A DIAMOND DRILL BIT "GETS IT IN THE RIBS" THAT'S GOOD!

Nature made the selected industrial diamond the most perfect of cutting elements, yet, few of the finer diamonds are in themselves, perfect.

Almost invariably, each has a minute but fortunate distortion in structure which is caused by the presence of the vital "hard vector" or "rib," known even to the ancients as the supreme cutting edge in nature's supreme cutting instrument.

It is traditional in the diamond setter's craft that this "rib," whenever discernable, shall be set "toward the work" so that each diamond may deliver maximum cutting power.

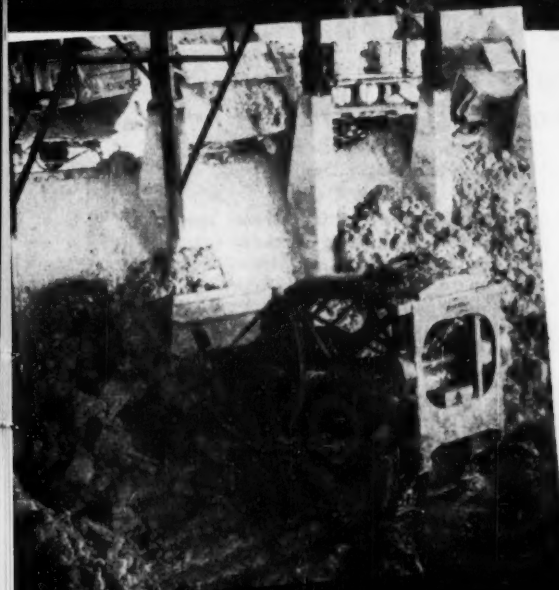
In Truco Diamond Drill Bits, these hard ribs "toward the work" are your assurance of maximum footage at minimum cost. And, when your Truco bits "get it in the ribs," that's good, because the ribs are there to take it.

WHEEL TRUEING TOOL COMPANY

3200 W. DAVISON AVENUE, DETROIT 6, MICHIGAN

WHEEL TRUEING TOOL CO. OF CANADA, LTD.

575 LANGLOIS AVENUE, WINDSOR, ONTARIO, CANADA



STOCK PILE LOADING

Loading clay with an Eimco 104 at a Southern clay operation has averaged 800 tons per shift for the better part of a year.

The clay material discharges easily and leaves the bucket clean.

This typical Eimco 104 loading job is repeated on many other types of material; rock, sand and gravel.

For economical, fast loading investigate Eimco loaders first.

EIMCO A409

THE EIMCO CORPORATION

The World's Leading Manufacturer of Vacuum Filtration Equipment

EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 10, UTAH, U. S. A.

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You Can't Beat an Eimco

HANDWORK ON THE ROCK PILE

Missouri lead mine—about 1890. The "ton per day" output of ore separators like this was limited by the stamina of men.

An enlargement of this photo suitable for framing is yours for the asking.

Times Have Changed...

Yesterday's blasting practices are as out-of-date as the hand-jig separator!

It took a lot of muscle to mine ore in the old days! Drilling hard rock with hand steel . . . bringing ore to the surface by hand windlass . . . separating rock with hand jigs was backbreaking labor.

Today, *mechanical* power takes the backbreak out of drilling, hoisting, and milling. What's more, miners at last can take full advantage of the power of explosives to bring out more ore at less cost—with less wear and tear on their machines.

But just as with other mining equipment, the operator must keep up with the latest to get the best—and the latest and best in explosives technique is the Atlas ROCKMASTER System, based on millisecond delay detonators.

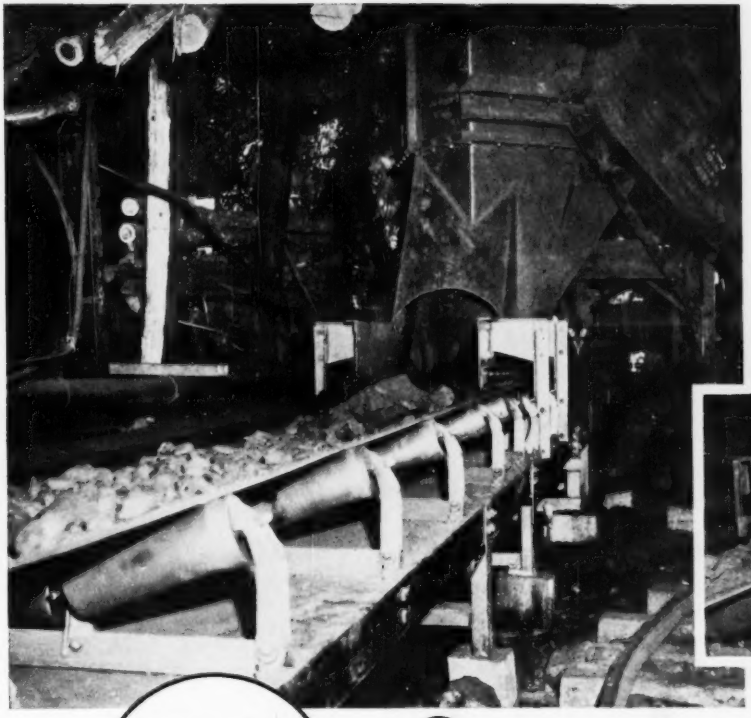
With ROCKMASTER blasting, miners now have much greater control over explosives energy . . . more control over breakage, throw, noise, and vibration than ever was possible before. And Atlas is constantly improving the ROCKMASTER Blasting System so that with proper drilling and loading miners can lower explosives costs and yet gain increased production.

Are *your* blasting practices right up to the minute? Better send for the free 20-page booklet on ROCKMASTER blasting.

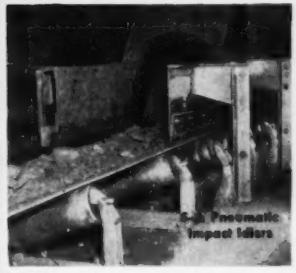
ATLAS EXPLOSIVES *"Everything for Blasting"*

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington 99, Del. • *Offices in principal cities* • *Cable Address—Atpowco*



S-A Belt Conveyors, 36" wide, carry iron ore from stopes to large ore pocket where it is hoisted to the surface. At all loading and transfer points, S-A Pneumatic Impact Idlers protect belt from impact of large lumps. Heavy duty Simplex Carriers are used to withstand shock of intermittent loading.



S-A CONVEYING *Systems* move LOW TONNAGES, too, at LOWEST COST...

Here's proof that low tonnage mines can also cut costs with S-A conveyor installations. This 1700-foot belt conveyor system handles only 300,000 tons of ore per year. However, its installation was decided on only after careful analysis of a similar system installed in a larger mine in 1946. Anticipated economies have been verified by several years of operation.

S-A conveying systems may be the economical answer to your materials handling problems, too. Find out by calling in a S-A engineer. He has a complete line of equipment to draw upon. And, as a result of years of experience, he knows how to best use this equipment in meeting your specific requirements. Write for a free survey.

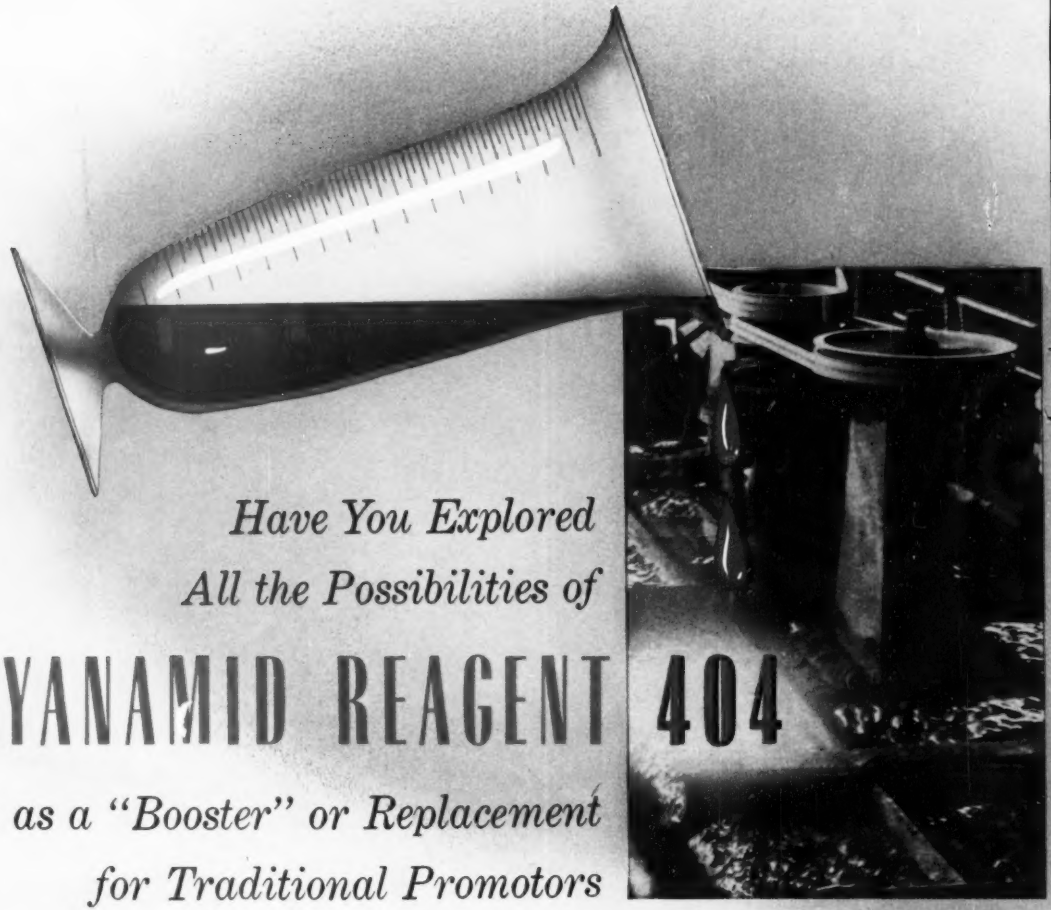
- Belt Conveyors
- Belt, Pan & Plate Feeders
- Ship Loading Boom Conveyors
- Stacking Conveyors
- Storage & Reclaiming Systems
- "Natural Frequency" Vibrating Conveyors
- REDLER Conveyor-Elevators
- ZIPPER Conveyor-Elevators
- Conveyor Belt Cleaners
- Headshaft Holdbacks
- Grizzlies & Screens
- Centrifugal Pilers
- Bin Gates & Tunnel Gates
- Car Pullers & Spotters
- Bucket Elevators
- Skip Hoists
- SEALMASTER Ball Bearing Units

• *Write for a bulletin on any of the above*

STEPHEN S-A DAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT



Have You Explored
All the Possibilities of

CYANAMID REAGENT 404

as a "Booster" or Replacement
for Traditional Promotors

Challenging time-honored ideas on reagent combinations, more and more metallurgists are sharpening selectivity, increasing recovery and reducing reagent costs by introducing Cyanamid Reagent 404 in their flotation circuits.

Fastest growing among the newer reagents in Cyanamid's complete line of metallurgical chemicals, Reagent 404 is already being used alone and in combination to beneficiate auriferous pyrite and pyrrhotite, tarnished and oxide lead, lead-zinc, copper-zinc, copper-lead, free gold, cobalt, antimony as well as other complex precious and base-metal ores. Each year, Reagent 404 finds new applications beyond its anticipated sphere of use.

Consider these four typical examples of the introduction of Cyanamid Reagent 404 as a "booster" or replacement for less effective promotors:

AMERICAN *Cyanamid* COMPANY

COPPER—PYRITE ORE, SILICIOUS GANGUE

PROBLEM: To reduce insoluble content of concentrate and increase copper recovery.

SOLUTION: Using Reagent 404 as part replacement of previous promotor produced these comparative test results in the mill.

		PROMOTOR lbs/ton	FROTHER lbs/ton	REAGENT COST	CONCENTRATE % Cu.	% Fe 0	% Insol.	TAILING % Cu.
Previous	Promotor X	.05	0.20	5.67¢	25.0	28.6	16.2	0.254
Present	Promotor X	.025	0.045	3.29¢	24.6	31.6	12.3	0.206
	Reagent 404	.032						

RESULTS: Reagent 404 lowers insoluble in concentrate and cuts reagent costs 42% (2.38¢ per ton of feed.)

PARTIALLY OXIDIZED LEAD ORE CONTAINING GALENA AND CERUSSITE

PROBLEM: To simplify the flow sheet and improve recovery of lead.

SOLUTION: Use Reagent 404 in place of usual type promotor and sulfidizing agent.

Product	ASSAY % Wt.	% Pb	% N-S Pb	% Distribution of Lead
Feed	100.0	11.05	2.91	100.0
Concentrate	16.6	65.0	——	97.6
Cleaner Tailing	4.4	2.23	——	0.9
Rougher Tailing	79.0	0.20	0.16	1.5

RESULTS: Excellent metallurgy with simple flow sheet and reagent combination. Water reclamation and circulation entirely feasible since Reagent 404 does not disperse tailing and thus interfere with thickening as would Sodium Sulfide. Galena and cerussite are floated in a single circuit, as compared with the necessity for two separate flotation circuits when a sulfidizing agent is used to recover cerussite.

AURIFEROUS PYRITE WITH NO FREE GOLD. CLEAN SILICIOUS GANGUE

PROBLEM: To increase recovery and reduce reagent cost.

SOLUTION: Use Reagent 404 as total replacement for promotors previously used.

		PROMOTOR lbs/ton	FROTHER lbs/ton	REAGENT COSTS	ASSAYS, Au, Oz/T FEED	CONC.	TAIL
Previous	Promotor A	0.10	0.07	5.23	0.129	5.16	0.006
	Promotor B	0.05					
Present	Reagent 404	0.05	0.05	2.60	0.175	5.07	0.005

RESULTS: Reagent 404 increases recovery of copper, lowers tailing by 3½¢.

GOLD—SILVER—LEAD—ZINC ORE

PROBLEM: To increase recoveries of gold, silver, and lead in the lead concentrate.

SOLUTION: Use of Reagent 404 as part replacement of previous promotor combination gave these comparative results.

		PROMOTOR lbs/ton	FEED, Oz/ton Au	Ag	% Pb	Pb Conc. Oz/ton Au	Ag	% Pb	Recoveries, Pb Conc. Au	Ag	Pb
Previous	Promotor A	0.10	0.12	4.2	2.5	0.80	36.0	24.7	43.0	56.8	65.1
Present	Promotor A	0.04	0.14	4.4	2.6	0.83	31.1	22.3	51.8	59.4	71.6
	Reagent 404	0.02									

RESULTS: Use of Reagent 404 increased the recovery of Gold 8.8%, the recovery of silver 3.4% and the recovery of lead 6.5%. Simultaneously, reagents costs were reduced by 1¢ per ton.

An objective review of your reagent combinations and treatment methods in the light of recent milling developments may reveal that Cyanamid Reagent 404 (or its companion Reagents 425 and 444) can help you to achieve lower cost-plus-tails on your present ore now and make it economic to treat lower-grade mill feed in the future.

Cyanamid Field Engineers and Cyanamid Mineral Dressing Laboratory keep constantly informed on metallurgical chemical advances and flow-scheme modifications in every mining field the world over. They stand ready to give you unbiased counsel and practical help in your reagent studies... to bring you the benefits of Cyanamid's fundamental research, testing facilities and on-the-mill experience in applying more efficient reagents and processes. Your inquiry is invited.

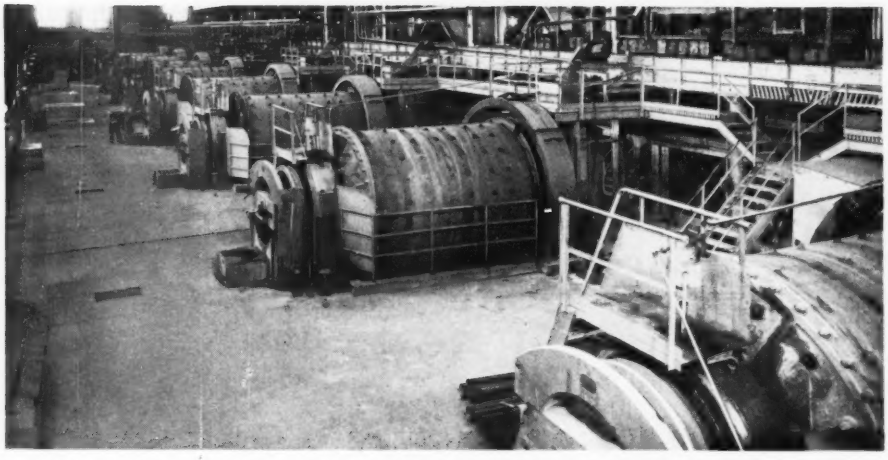
MINERAL DRESSING DIVISION 30 ROCKEFELLER PLAZA NEW YORK 20, NEW YORK

Printed in U.S.A.

LEADING COPPER COMPANY

- **REDUCES COSTS**
- **IMPROVES OPERATING CONDITIONS**

WITH *MARCY* MILLS



11 - 9½'x12' Marcy Open End Rod Mills Installed as a Result of Comparative Tests

Primary grinding in this large copper mill was being done by a series of 2-stage roll-screen circuits. A 9½'x12' Marcy Open End Rod Mill was installed in parallel with them. As a result of this test 11 - 9½'x12' Marcy Open End Rod Mills have replaced all roll-screen circuits.

GRINDING DATA:

Feed: 1½" hard ore.

Grind: 4% + 10 mesh; open circuit.

Tonnage: Up to 2700 tons per day, each mill

RESULTS:

- **Prepared better and more economical feed for regrind mills with greater amount of finished product.**
- **Lowered maintenance and operating costs by replacing complex circuits of rolls, screens, elevators and launders.**
- **Cleaner, healthier, safer working conditions.**

Eliminate overgrinding with Marcy's principle of rapid circulation of mill content

Other MASSCO products: Massco-Fahrenwald Flotation Machines, Genuine Wilfley Tables, Massco-McCarthy Hot Millers, Rock Bit Grinders, Density Controllers, Belt Feeders, Rubber Pinch Valves, Assay and Laboratory Supplies and Equipment, Complete Milling Plants.

The Mine & Smelter Supply Co.

Box 5270, Terminal Annex, Denver, Colo., U.S.A.

Offices in Salt Lake City, El Paso, 1775 Broadway, N. Y. C.

Canadian Vickers, Ltd., Montreal, Can.; W. R. Judson, Santiago, Chile; The Edward J. Nell Co., Manila, P.I.; The Austral Otis Eng. Co., Ltd., So. Melbourne, Austr.; Margardshammars Mek. Verkstads Aktiebolag, Margardshammar, Sweden; The Ore & Chemical Corp., 80 Broad St., New York 4, N. Y., representatives for Continental Europe.

ROCK RATED!

FOR ROCK BOTTOM COSTS

P&H MAGNETORQUE*

puts an end to the old swing frictions

We'll make this promise: You'll never have to "baby" this machine, even in the heaviest going! It's *built* for it — all-welded of alloy steels throughout, the toughest construction known. *It means steady digging.*

But the big pay-off in extra production comes with Magnetorque electric swing — enough faster to deliver 5 cycles to 4 on other machines in the 2½ yd. class. And the "time-outs" for adjustment and replacement of swing friction linings can now be salvaged for increased yardage. Magnetorque lasts the life of the machine.

*T.M. of Harnischfeger Corporation for electro-magnetic type clutch.

HARNISCHFEGER
CORPORATION
4400 W. National Avenue • Milwaukee 46, Wis.

Ask today for facts about the 955-A. Also the Model 1055 — its companion machine with 3½ yd. capacity.

POWER SHOVELS • CRAWLER AND TRUCK CRANES • OVERHEAD CRANES • HOISTS • ARC WELDERS AND ELECTRODES • SOIL STABILIZERS • DIESEL ENGINES • PRE-FABRICATED HOMES

AGAIN... KENNEDY PRESENTS AN INNOVATION IN CRUSHING EQUIPMENT!

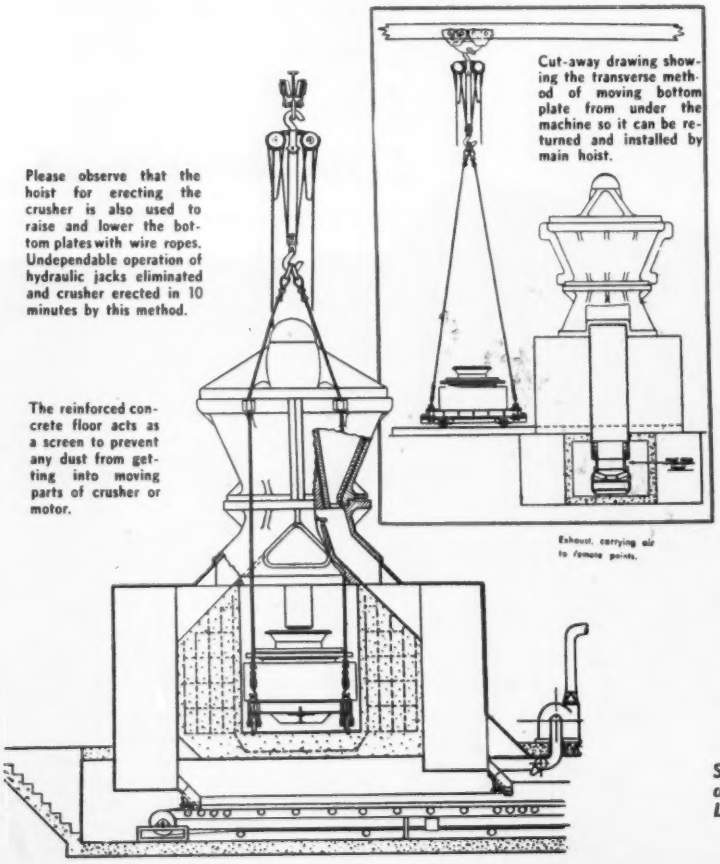
NEW Gyratory Crusher with Dual Discharge Outlets Increases Output and Efficiency

Only KENNEDY has the correct answer to the "Sticky Ore" problem! KENNEDY Gearless Gyratory Crushers are now built with TWO DISCHARGE OUTLETS plus an exclusive "No-Stick" feature that increases efficiency and output. This distinct innovation in crusher design is another "FIRST" for the world-famous line of KENNEDY crushing equipment.

Hard-to-crush rock and ore such as limestone, trap rock, basalt, taconite, slag, etc., containing as high as 50% clay, can be handled without sticking or clogging by the exclusive KVS process.

No other crusher offers this advantage. Double discharge outlets, built at angle of 70 degrees, assure uninterrupted delivery of material. Other crushers, with single 42 degree outlets, cannot compare because the discharge outlet becomes clogged with sticky clay or taconite ore.

In the new KVS crushers, rock and ore pass through mantle and concaves at bottom. A vertical drop of 6 feet then quickly and surely disgorges sticky clay, etc.—greatly speeds production by eliminating clogging—saves countless man hours clearing stalled crushers.


Cut-away drawing showing the transverse method of moving bottom plate from under the machine so it can be returned and installed by main hoist.
Please observe that the hoist for erecting the crusher is also used to raise and lower the bottom plates with wire ropes. Undependable operation of hydraulic jacks eliminated and crusher erected in 10 minutes by this method.
The reinforced concrete floor acts as a screen to prevent any dust from getting into moving parts of crusher or motor.
Exhaust, carrying air to remote points.

CHECK THESE FEATURES!

Synchronous motor built into pulley assembly

Smooth frictionless operation because the crusher is gearless

Power used ONLY for crushing

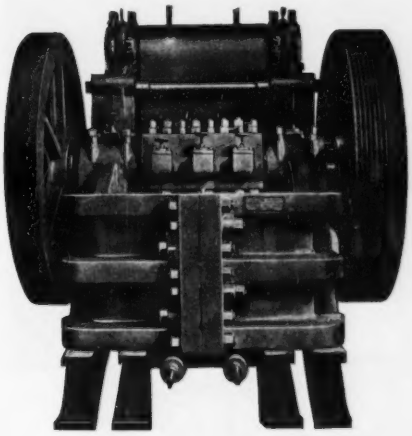
All moving parts carried on self-aligning roller bearings

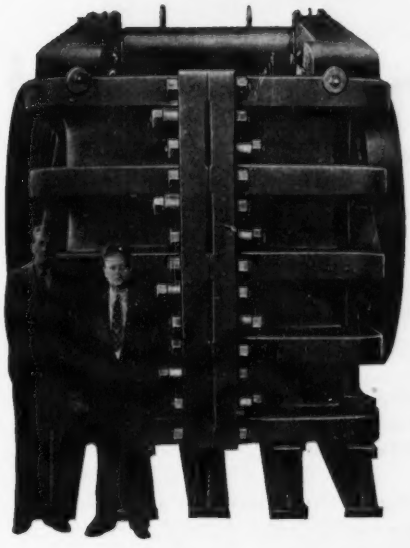
KVS forced-feed oiling system pumps four barrels of oil per hour through bearings without waste

Eccentric and ball are spray babbited. NONE has been rebabbited in over three years

Send for bulletins describing all types of KVS crushers. Let us prove that "It Costs Less To Own The Best".

KENNEDY Swing Jaw Crushers





2-Section Split Frames of Herculite Steel

Built to "Take It" as Well as "Give It"

The strongest heavy-duty crushers ever built! Designed by KVS engineers to handle maximum rock and ore loads . . . built to reduce those "Hard-to-Crush" raw materials with minimum effort and lowest power consumption.

Real gluttons for work . . . versatile, sturdy, ready and able to handle the toughest crushing assignment and ask for more! Dependable under all operating conditions . . . trouble-free . . . constructed to give years of service . . . able to "take it" as well as "give it".

Swing jaws are reversible, end-to-end, side-to-side, to give *twice* the wear of ordinary types. Jaw plates made in one piece; swing jaw shafts cast integral with swing jaws . . . excessive wear eliminated.

All-in-all, the strongest jaw crusher built. Made in various sizes to meet your own specifications. Ask our engineering department to submit operating data, capacities, weights, etc.

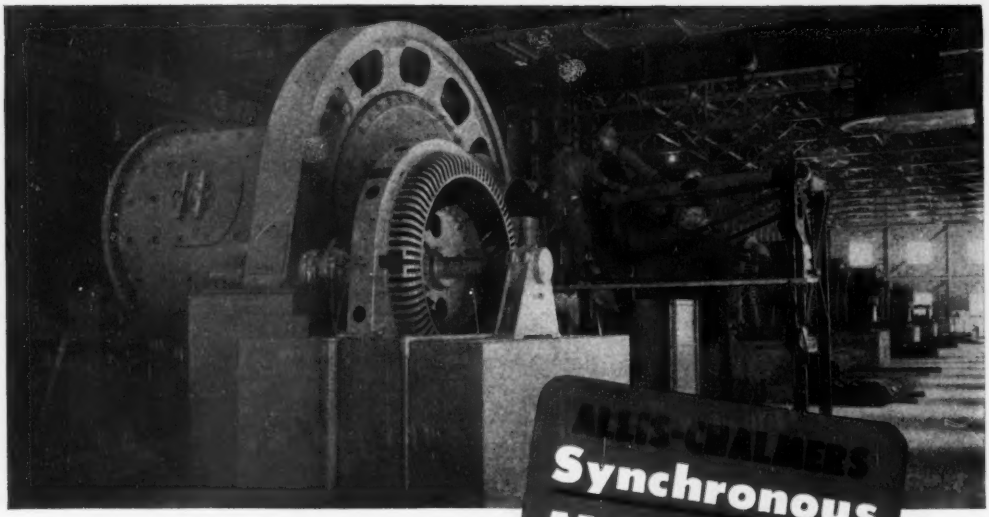
Send for illustrated bulletin
describing KVS swing jaw crushers.

EXCLUSIVE FEATURES OF THE KVS SWING JAW CRUSHERS . . .

- Frames built of open hearth or Herculite steel with tensile strength of 60,000 lbs per sq inch
- Counter-balanced fly wheel for lifting pitman at bottom of stroke. Hoisting engine or jacks not required to start machine
- Frames made in two sections, bolted together at centers. Bolts thrown into tension whenever strain develops. This exclusive KVs feature is superior to construction methods where machines are joined at corners.
- Rigid strength of frames; toughness of jaw plates adds years of service to crusher; enables it to better withstand shock and stress of crushing tough rock and ore.

IT COSTS LESS.. TO OWN THE BEST!

KENNEDY - VAN SAUN
MANUFACTURING & ENGINEERING CORPORATION
TWO PARK AVENUE, NEW YORK
FACTORY DANVILLE, PA.



Five Allis-Chalmers synchronous motors and 9 x 12 rod mills in new midwestern lead ore processing plant. Motors are rated 450 hp, 100% pf, 440 volts, 257 rpm.

Built for a Long Grind

Here are three reasons why Allis-Chalmers grinding mill motors help keep your mills grinding economically year after year:

Each motor is engineered for its job. A-C's half century of experience building electrical equipment *and* processing machinery assures torque and other operating characteristics tailored to the individual installation requirements.

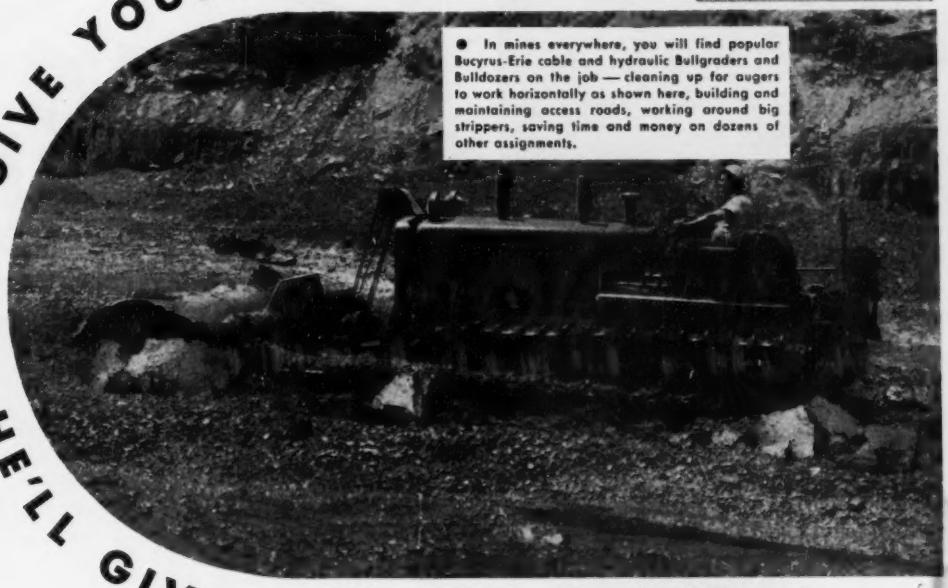
Time-proved basic design features contribute to long life and trouble-free operation. These are described in Bulletin 05B7648.

Adequate manufacturing, inspection and testing facilities insure that each motor will be built exactly as specified.

For more information on motors that minimize maintenance and down-time, call in your A-C representative, or write for illustrated Bulletin 05B7648. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3883

ALLIS-CHALMERS

GIVE YOUR OPERATOR THE OUTFIT



● In mines everywhere, you will find popular Bucyrus-Erie cable and hydraulic Bullgraders and Bulldozers on the job — cleaning up for augers to work horizontally as shown here, building and maintaining access roads, working around big strippers, saving time and money on dozens of other assignments.

● HE'LL GIVE YOU THE OUTPUT

With an easy-to-handle Bucyrus-Erie Bulldozer or Bullgrader your operator has a digging tool that's designed to give him the most in work capacity and safety — at a minimum of effort. For example:

He Sees What He's Doing . . . Hydraulic cylinders are well back; on cable-operated units, front support frame or side beams are low. The operator can see exactly what the blade is doing — and stay seated. No superstructures to obstruct his vision.

. . . Is In Complete Command Center of gravity is kept low for greater stability when working on steep banks. Also with tractor balance point kept practically intact, blade doesn't tend to nose over at the edge of the dump, tractor works at top efficiency.

BUCYRUS ERIE

BULLGRADERS and BULLDOZERS

. . . And Comfortable Single, four-position hydraulic control lever is within easy reach of the operator, yet does not interfere with tractor controls. Winch control levers for cable-operated blades are easy to operate — conveniently located.

In addition, Bucyrus-Erie Bullgraders can be angled and tilted by the operator in a few minutes without special tools. Lubrication points are easily accessible. Your International Industrial Tractor distributor will be happy to give you full details. 37152

See Your INTERNATIONAL Industrial Tractor Distributor

BUCYRUS-ERIE COMPANY
South Milwaukee, Wisconsin

Here's why more than 32,000 mine cars have been built with U·S·S COR-TEN steel

● U·S·S COR-TEN is a ductile, low-carbon chromium-nickel-silicon-copper-phosphorus steel having a minimum yield point, in thickness of ½" and under, of 50,000 psi—at least one and one-half times that of structural carbon steel.

It has a minimum tensile strength of 70,000 psi in these same thicknesses. Its resistance to abrasion and shock is superior to structural carbon steel; its fatigue resistance—that is, its ability to withstand vibration stresses—is 60% greater.

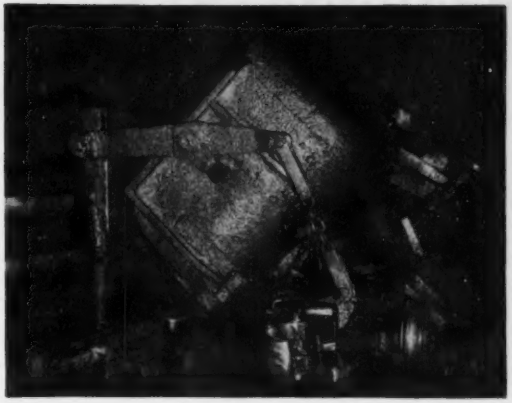
What particularly distinguishes U·S·S COR-TEN steel is its very high resistance to atmospheric corrosion—4 to 6 times that of plain steel, 2 or 3 times that of copper steel. This property helps to assure the safety, long life and low maintenance cost of any equipment in which COR-TEN steel is used, whether to obtain greater durability, or in lighter thicknesses to reduce weight.

U·S·S COR-TEN High Strength steel is produced in all standard products—plates, shapes, bars, sheets, strip, special cold formed sections, wire and tubular products. It is recommended particularly in light and intermediate thicknesses.

★

Twenty-two 74-cu. ft. mine cars put into service eleven years ago. ¼" COR-TEN steel used in body and floor plates. Each car has handled over 85,000 tons of highly abrasive ore.

★



...that U·S·S Cor-Ten HIGH STRENGTH Steel will give your equipment the stamina to stay on the job!

BUILT in 1941 by the C. S. Card Iron Works Company for a western copper mine, 22 mine cars were designed to be used with a 12-inch grizzly.

Instead, for eleven years, they have been loaded from a 24-inch grizzly, handling chunks of very abrasive ore up to 2′ x 4′ in size—twice as big and twice as heavy as they were designed for.

Despite this, and after operating day-in and day-out under highly corrosive conditions, the cars are still on the job and ready for more service, although each car has already handled more than 85,000 tons of ore.

This case is typical. It illustrates the added ruggedness and durability that you can confidently expect when your equipment is built with U·S·S COR-TEN steel.

With this tougher, stronger steel that offers high resistance to atmospheric corrosion, to wear, impact, shock and fatigue, you can materially increase the stamina of parts without increasing their weight. With U·S·S COR-TEN steel, not only mine cars, but buckets, skips and cages, shovels, trucks, scrapers, dozers, carryalls, etc., can be built to last longer and to do more work.

For 17 years our engineers have cooperated with the mining industry in applying U·S·S COR-TEN steel to equipment noted for its dependability, long life and low maintenance cost. We will be glad to show you how this superior high strength steel can be most economically applied to make your equipment more efficient.

UNITED STATES STEEL COMPANY, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

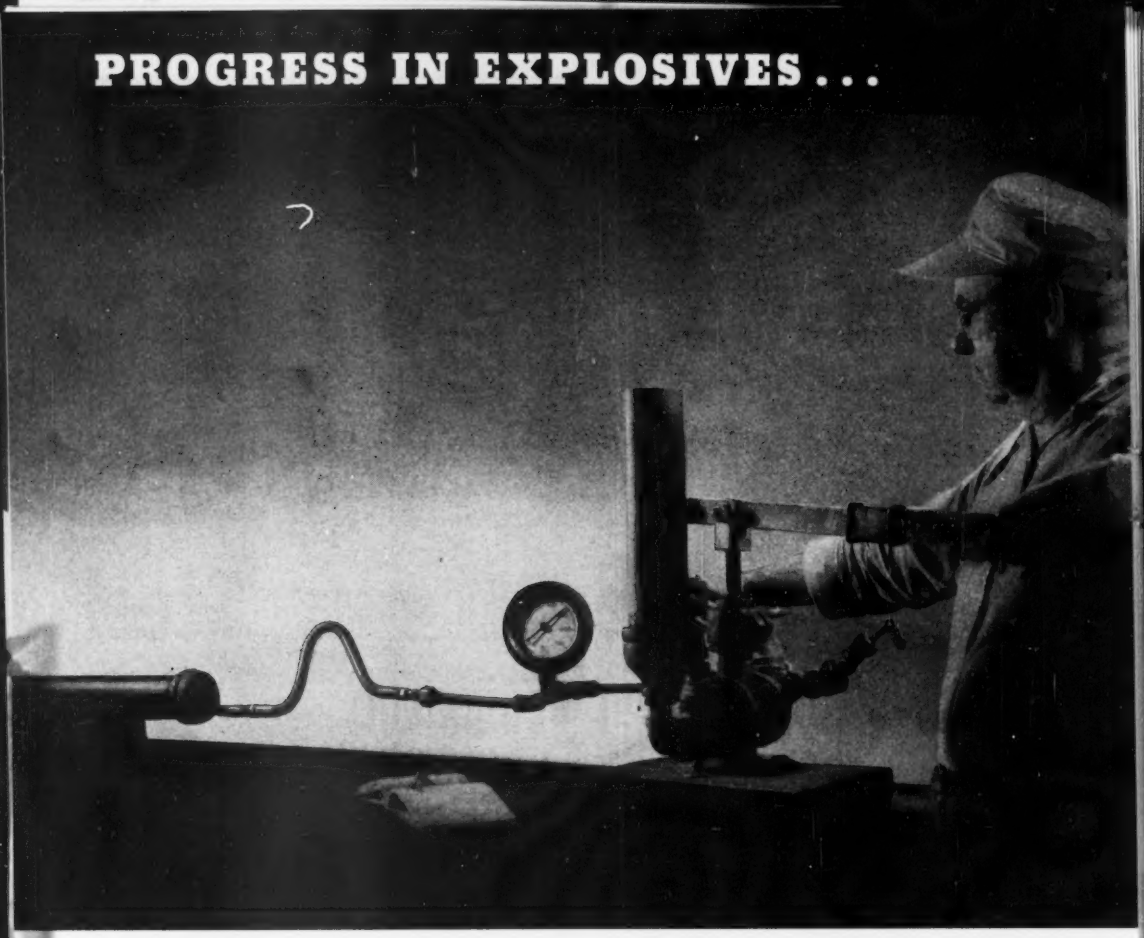
U·S·S COR-TEN High Strength STEEL

USS

8-1497

UNITED STATES STEEL

PROGRESS IN EXPLOSIVES...



FOR WORKING UNDER PRESSURE

Hercules' research has developed explosives that shoot successfully even under the severe water pressures encountered today in seismograph prospecting.

In the laboratory test shown here, a cartridge of Hercules Vibrogel® 3 is sealed in the steel "bomb" at the extreme left. It then undergoes prolonged exposure to pressures greater than those ordinarily found in actual field use. Because Vibrogel 3 embodies a new conception of explosives research, it detonates despite these extreme conditions.

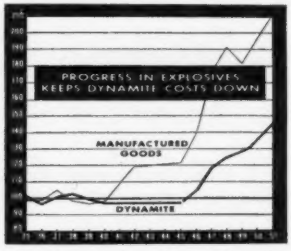


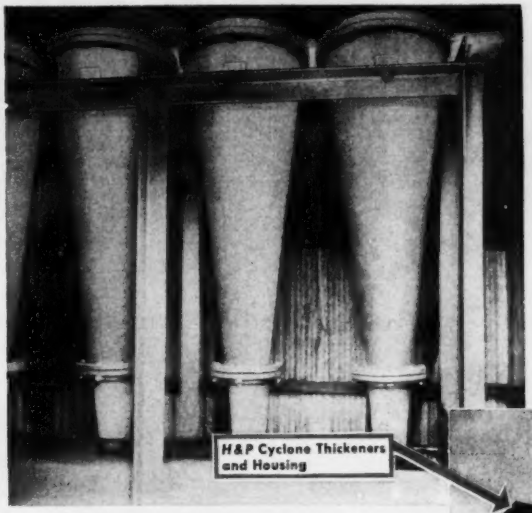
Chart shows relative stability of dynamite prices since 1935, as compared with prices of other manufactured goods. 1935-39 values=100.

HERCULES POWDER COMPANY

INCORPORATED

Explosives Department, 933 King St., Wilmington 99, Del.

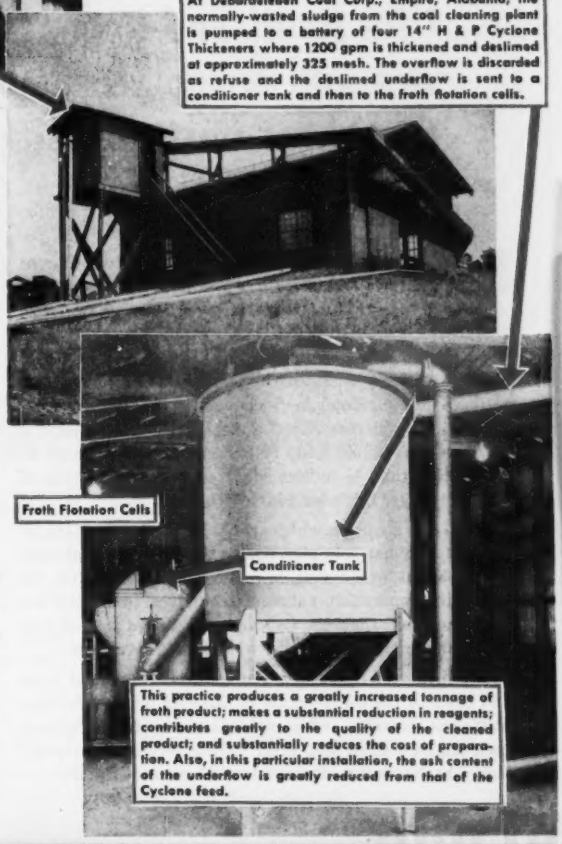
XR52-7



DESLIMING Ahead of FROTH FLOTATION with H+P CYCLONE THICKENERS

Increases Froth Product and Reduces Preparation Costs

At DeBardeleben Coal Corp., Empire, Alabama, the normally-wasted sludge from the coal cleaning plant is pumped to a battery of four 14" H & P Cyclone Thickeners where 1200 gpm is thickened and deslimed at approximately 325 mesh. The overflow is discarded as refuse and the deslimed underflow is sent to a conditioner tank and then to the froth flotation cells.



This practice produces a greatly increased tonnage of froth product; makes a substantial reduction in reagents; contributes greatly to the quality of the cleaned product; and substantially reduces the cost of preparation. Also, in this particular installation, the ash content of the underflow is greatly reduced from that of the Cyclone feed.

The use of Heyl & Patterson Cyclone Thickeners by the DeBardeleben Coal Corporation at Empire, Alabama for desliming ahead of froth flotation marks another successful application of this versatile equipment in the mining and preparation fields.

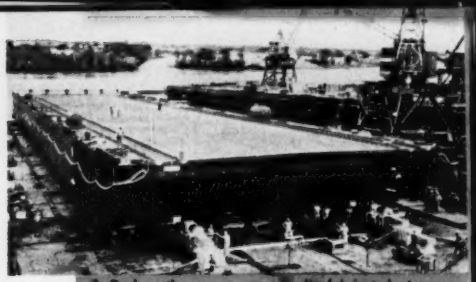
H & P Cyclone Thickener equipment is a proven means of controlling solids in circulating systems and separating solids from liquids. H & P Cyclones also provide an economical and practical answer to Classification and Thickening problems.

Heyl & Patterson laboratory and field tests have provided a sound basis for predicting accurately the Cyclone performance on most feeds. For more information send for Booklet 5-CT-51 or send us your problem and we will tell you how an H & P Cyclone application can provide the answer.

Cyclone Thickeners
Thermal Dryers
{The Drying Dutchman
{Heinevold Centrifugal Dryer}
Thorsten Coal Handling Systems
Rotary Mine Car Dumpers
Coal Crushers
Coal Preparation Plants
Bradford Breakers

Heyl+Patterson, Inc.
"SINCE 1887"
55 WATER STREET · PITTSBURGH 22 PA.

1. Shortly after arrival at Orinoco River site, dock 376 ft. long, 82 ft. wide, 15 ft. deep berths ship, and unloading begins. Two additional units make this pier 1130 ft. long.



2. Dock sections were economically fabricated at an Orange, Texas yard and launched for towing to pier site.

In a matter of hours

sea-going dock-barge lifts itself and becomes ore and cargo pier ready for berthing ships

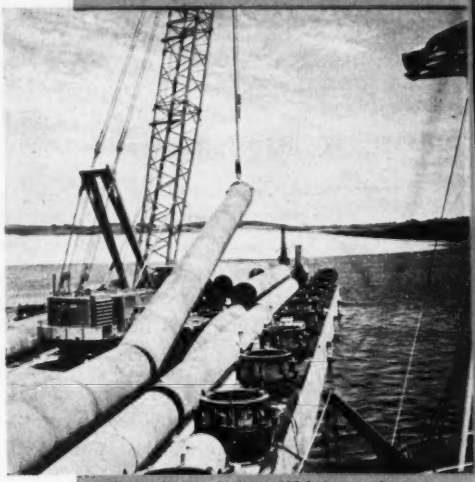
3. Loaded dock section arriving at site on Orinoco River, Venezuela, after being towed across 3,000 miles of ocean. Dock carried caissons, crane, air jacks, compressors and receivers, and all other installation gear.

Field work is practically eliminated in dock construction, however remote, due to the development of the patented DeLong jack.

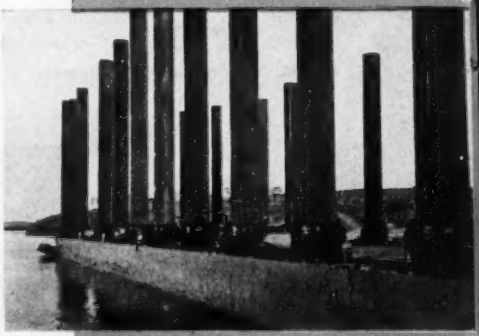
The DeLong jack was first used in the construction of drilling platforms in the Gulf of Mexico several years ago. A DeLong dock has been in use for over a year at an Arctic installation, successfully withstanding the blows of waves, wind, ice, and the berthing and unloading of ocean going vessels. Another installation nearing completion is the Orinoco Mining Company's new ore and cargo handling wharf on the Orinoco River. Composed of three units, the Orinoco pier will be 1,130 ft. long, 82 ft. wide and 15 ft. deep. More than ½ million sq. ft. of the DeLong type of pier are in use or under construction.

The DeLong air jacks, which are the key to the whole transformation of barge to pier, enable the dock to "climb" the steel columns, or caissons, to required elevation. After the self-lifting operation, caissons are driven to refusal for permanent installations. Caissons are welded to deck and cut off flush; then tops closed with welded cover plate.

The DeLong air jack method of installation can cut time and costs in the construction of offshore oil well drilling platforms, portable and permanent piers, etc. A DeLong dock can be erected and, after having served its purpose, jacked back to water level and towed to a new location.



4. Crane placing 6 ft. diam., 100 ft. long steel caissons in wells fitted with air jacks.



5. Caissons held in position by air jacks until barge is jockeyed into final position. Caissons are then dropped to river bottom and DeLong air jacks lift deck to final height. Control of jacks is so precise, height of deck can be regulated to 1/16 of an inch.

DeLong

Engineering & Construction Co.

DECCO INTERNATIONAL CORPORATION

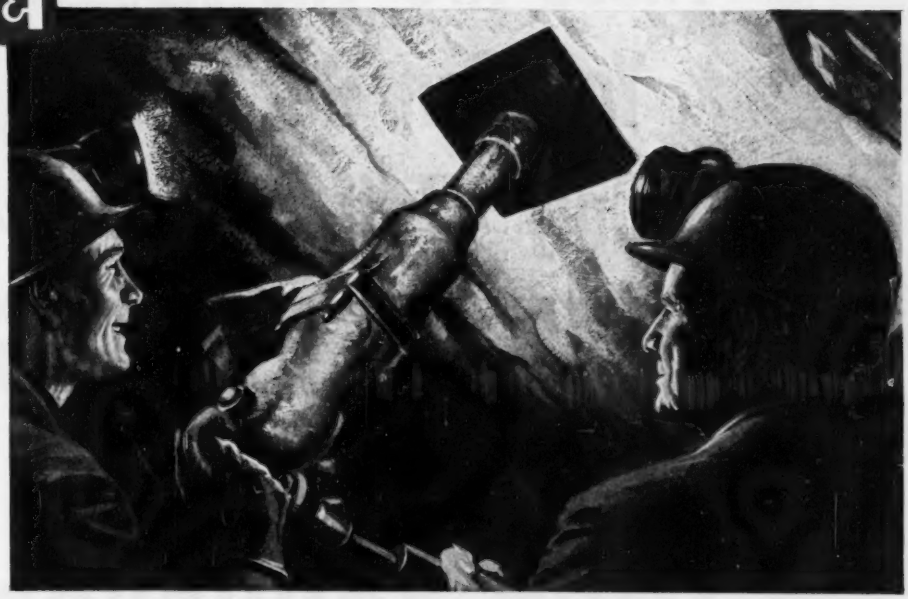
29 BROADWAY, NEW YORK 6, N. Y.

Phone: HAnover 2-1275

WASHINGTON 5, D. C.	SEATTLE, WASH.	CARACAS, VENEZUELA	SAN FELIX, VENEZUELA
729-15th St., N. W.	32nd Floor, Smith Tower	Apartado 968	

CF&I

STEEL PRODUCTS FOR THE MINING INDUSTRY



ROCK BOLTS

SAFETY... Support is furnished within a few inches of the face or heading... blasting has little or no effect on the bolts. Affords better support than timbering.

ECONOMY... Bolts store in less space... handling and transportation costs are reduced. Greater permanence — less replacement.

BETTER HOUSEKEEPING... Rock bolts provide more clearance overhead and on the sides. Ventilation is improved by the elimination of caps and posts.

• • •

Investigate the use of CF&I Rock Bolts for your own mining operation.

CF&I Products for the Mining Industry

Cal-Wic Wire Cloth Screens • Mine Rails and Accessories • Rock Bolts
Wickwire Rope • Grinding Balls • Grinding Rods

THE CALIFORNIA WIRE CLOTH CORPORATION, OAKLAND
THE COLORADO FUEL AND IRON CORPORATION, DENVER and NEW YORK

CF&I
ROCK BOLTS
THE COLORADO FUEL AND IRON CORPORATION

1118

HEWITT-ROBINS

These Are The Results You Can Get Only With A HEWITT-ROBINS ORE MINE CONVEYOR

HERE'S

- First unit of its type to demonstrate successful ability to handle such things as *metallic ore* for stope and main haulage.
- All members specially designed for handling ore —including terminals and intermediate sections.
- Drop-in intermediate sections available in 8', 10' & 12' lengths and in widths 26", 30", 36", 42" and wider.
- A choice of 4 idler sizes—genuine Hewitt-Robins 4", 5", 6", & 7" idlers.

ONLY HEWITT-ROBINS IS ABLE TO TAKE SINGLE UNIFIED RESPONSIBILITY FOR A

PROOF...

This is an actual example of what you can do when you install a genuine Hewitt-Robins Ore Mine Conveyor underground . . .

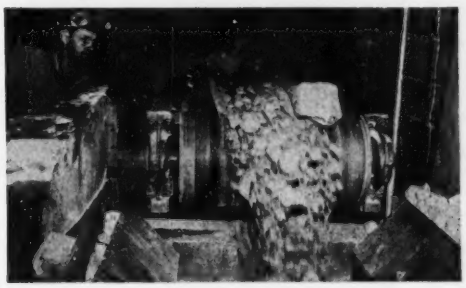
Conventional Methods Costly

A western copper mine operated three stopes by conventional methods in extremely heavy ground with rock highly altered and high moisture content. Ore moved from the stopes on short transfer raises, was bottomed in individual pony set chutes and drawn to haulage cars in a standard haulage drift.

Results were not too good . . . costs were too high because of excessive weight conditions with track haulage. This method also limited the tonnage that could be drawn each 24 hours due chiefly to time out for haulage drift repairs. This, in turn, requred that extraction openings be maintained at a high cost over too long a period.

The Hewitt-Robins Solution

To solve the problem, a 200-foot Hewitt-Robins Ore Mine Conveyor was installed as a lateral transfer unit in a sub-drift under the slusher and grizzly level.



The benefits were immediate. Faster, more uniform drawing was possible with less time exposure to excessive maintenance costs. And 1,400 to 1,600 tons/day were drawn compared with approximately 632 tons/day average in the best of the previous 3 stopes. Now, more blocks are being caved, using additional Hewitt-Robins Ore Mine Conveyors.

Simplifies Timber Repairs

Whereas timber repairs on the haulage levels formerly had to be done on a shift when the stope was down (because track operation interfered with repair crews) all necessary repair work in the conveyor drift can be done while ore is moving and the stopes are in full operation.

Simpler, faster train cycle operation is also possible. No longer is there the need to shop around from 4 pony set chutes to load out a 25-car train . . . haulage cars are loaded at the discharge end of the conveyor.

Greater Savings Possible

Mine operators can expect even greater continuity with the Hewitt-Robins Ore Mine Conveyor where the mine is completely conveyorized. For there the flow of material would be continuous from stope to surface.

Get the whole story—write for complete information today!

HEWITT-ROBINS HR INCORPORATED

STAMFORD, CONNECTICUT

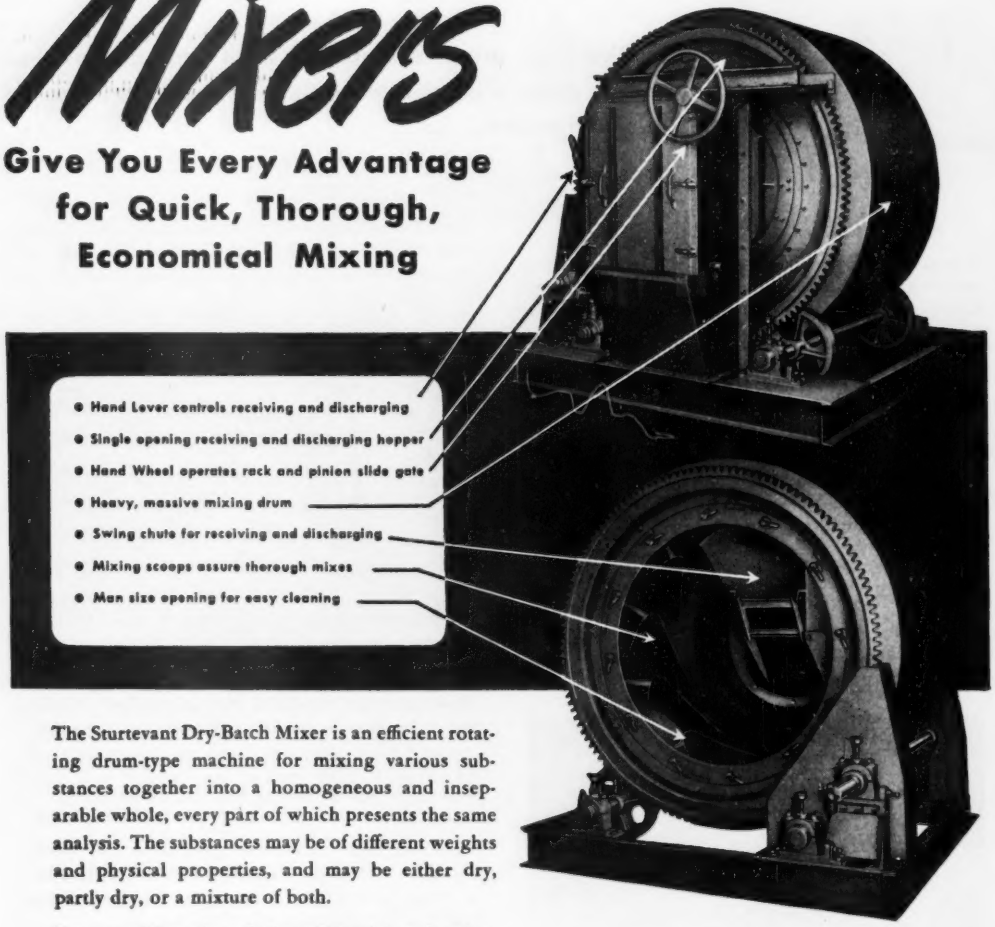
402 RANDOLPH ST., CHICAGO 6, ILL. **718 E. HOWARD ST., HIBBING, MINN.**

BELT CONVEYOR INSTALLATION—ONLY HEWITT-ROBINS MANUFACTURES BOTH MACHINERY AND BELT

Sturtevant Dry Batch

Mixers

Give You Every Advantage for Quick, Thorough, Economical Mixing


• Hand Lever controls receiving and discharging
• Single opening receiving and discharging hopper
• Hand Wheel operates rack and pinion slide gate
• Heavy, massive mixing drum
• Swing chute for receiving and discharging
• Mixing scoops assure thorough mixes
• Man size opening for easy cleaning

The Sturtevant Dry-Batch Mixer is an efficient rotating drum-type machine for mixing various substances together into a homogeneous and inseparable whole, every part of which presents the same analysis. The substances may be of different weights and physical properties, and may be either dry, partly dry, or a mixture of both.

Because of the unique design of its mixing chamber, and the 4-way mixing action which brings two or more substances together, the Sturtevant Dry-Batch Mixer does a more rapid mixing job than other machines and, at the same time, it is complete and thorough in every particular.

Write for bulletin today.

Compare These Advantages

- Only one lever controls both receiving and discharging for simplicity of operation. Hand wheel operates rack and pinion slide at feed opening.
- 4-way mixing action speeds production...assures thorough blends.
- "Open-door" accessibility permits easy, fast, thorough, cleaning.
- Single aperture drum for both intake and discharge.
- Unusually efficient scoops pick up materials to effect thorough mixing as drum revolves.
- 5 models . . . a size for every mixing job . . . smallest size mixes up to 7½ tons per hour . . . largest size up to 75 tons per hour.

STURTEVANT MILL COMPANY

101 Clayton Street, Boston 22, Mass.

Designers and Manufacturers of:

CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
ELEVATORS • MIXERS
MECHANICAL DENS and EXCAVATORS

Figure what YOU can save with the new

JOY S-91T TELESCOPIC FEED STOPER

Top views show the stoper with feed leg closed, to start the hole.

Bottom views show the S-91T with its telescopic feed leg extended.

Check these Advantages!

FEWER STEEL CHANGES

Now—36" steel changes with the Joy S-91T! In most cases, this eliminates at least one length of steel—cuts your investment in drill steel by 30 to 50%—lets you get full benefit from carbide or other long-wearing bits.

MORE TIME FOR DRILLING

With less time out for changing steel, there's more time for making footage. That means more feet of hole per drilling shift, at lower cost per foot. Less work for your drill operators, too—they'll like and prefer the S-91T.

SHORT LENGTH—LOW WEIGHT

The telescopic feed leg makes possible 36" steel changes while decreasing the overall length of the drill, and without appreciably increasing its weight. Only 52" long, the S-91T is ideal for narrow stopes, starting cross cuts, etc.

EXCLUSIVE DRILLING FEATURES

With "thumb-flip" rotation control for safe, easy spotting of holes—with the famous Joy "Dual Valve" that makes air do more work—the S-91T definitely represents the latest improvement in stoper design. ● Let us *prove* it!

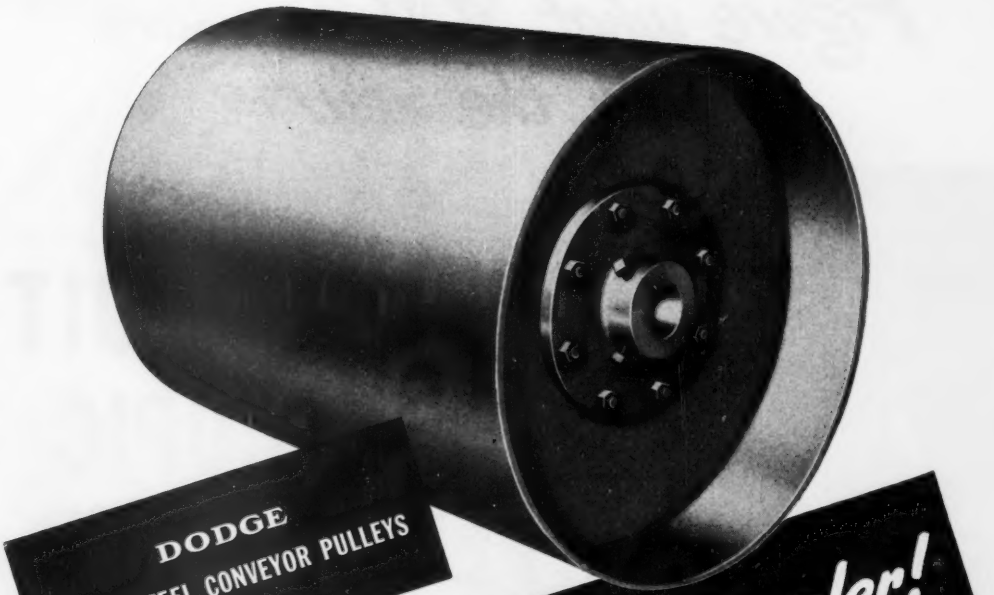
Consult a Joy Engineer

WAD M3284

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO



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SOLID STEEL CONVEYOR PULLEYS

So-o much Simpler!

- The pulley for *modern* belt conveyors.
- Drum type construction provides maximum strength with minimum weight.
- Interchangeable hubs simplify installation, positioning, removal — insure better conveyors at *less* cost.
- Accurately formed. Uniform rim thickness. Fully enclosed — to exclude dust, dirt, water.
- Diameters 6 in. to 8 ft., all face widths. Popular sizes stocked by our distributors.

DODGE *of Mishawaka, Ind.*

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Equipment" in your classified telephone directory.

DODGE MANUFACTURING CORPORATION
3100 Union Street, Mishawaka, Indiana

FIRST IN POWER TRANSMISSION MACHINERY!

V-BELTS AND TAPER-LOCK SHEAVES

TORQUE-ARM SPEED REDUCERS

DODGE-TIMKEN PILLOW BLOCKS

ROLLING GRIP AND DIAMOND D CLUTCHES

in WIRE ROPE, too, extra strength demands the RIGHT KIND of muscle

Towering as high as eight feet on his hind legs, the Kodiak or Alaskan Brown Bear ranks as the most powerful animal of North America. Rugged muscle development makes him the feared and deadly fighter that he is.

In wire rope, too, the right kind of muscle is essential to ward off the destructive effects of abrasion, corrosion, bending fatigue, load strain and shock stress.

That's why in Wickwire Rope we make sure—through complete quality control—that you always get the right construction and lay of the rope... the right grade of steel and size of wire for long-lasting resistance to the rigors of your particular service.

See your Wickwire Rope distributor or contact our nearest sales office.

THE COLORADO FUEL AND IRON CORPORATION—Abilene (Tex.) • Denver • Houston • Odessa (Tex.) • Phoenix • Salt Lake City • Tulsa
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WICKWIRE ROPE
A CF&I PRODUCT

1222

A YELLOW TRIANGLE ON THE REEL IDENTIFIES WICKWIRE ROPE

WICKWIRE ROPE

CF&I

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

MICROMETER DEPTH INDICATORS in the Console...

(Nordberg Patent)

This Nordberg tandem, double drum underground hoist is installed in an Anaconda mine. It was designed for a depth of 1600 ft., using 8 ton skips and hoisting 6 tons of copper ore at a rope speed of 800 ft. per min.

... another reason why the Mining Industry looks to NORDBERG as the leader in Mine Hoist design and development

● SINCE 1895, Nordberg has enjoyed world-wide leadership in the hoist field, specializing in building large or unusual hoists . . . and has been the source of the most progressive hoist engineering advances in the mining industry.

Micrometer Depth Indicators in the Console, for example, is just one of the advanced engineering features that has made Nordberg the leader in the design and development of modern mine hoists. This, and many other important engineering refinements, assures the very best in workmanship and materials to give you the ease of operation, safety and dependability which has made Nordberg Mine Hoists the standard for comparison.

No matter what your hoisting requirements may be, you will find that Nordberg hoist engineers are fully qualified to solve your specific problems. Write for further details, or send for Bulletin 190.

M552

NORDBERG MFG. CO., *Milwaukee, Wis.*

"SYMONS" . . . a Nordberg trademark known throughout the world

NORDBERG MACHINERY

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SYMONS SCREENS NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

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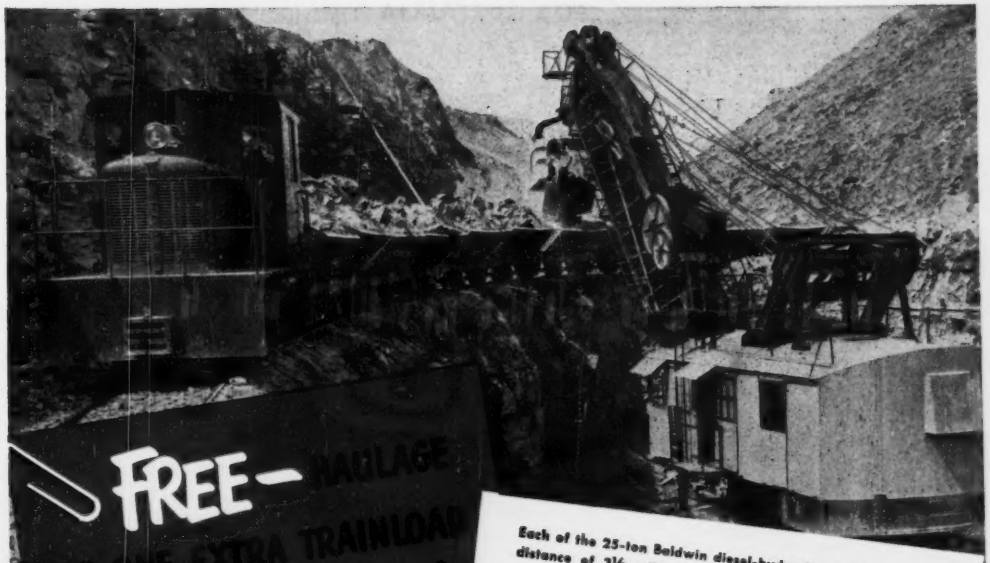
"SYMONS" Primary Crushers

Grinding Mills

Mine Hoists

"SYMONS" Vibrating Bar Grizzlies and Screens

Diesel Engines



FREE— HAULAGE OF ONE EXTRA TRAINLOAD EVERY SEVEN TRIPS!

Each of the 25-ton Baldwin diesel-hydraulics pulls 12 cars for a distance of 3½ miles, total trainloads upwards of 100 tons.

It's a cost-cutting result of using Baldwin Diesel-Hydraulics!

Switching to Baldwin diesel-hydraulics has paid big dividends to The Carbon Limestone Company. More than 20% more stone is hauled each trip! Eight men, out of a 16 man stone haulage crew, have been transferred to other work!

This operating record is typical of the cost-cutting advantages of Baldwin diesel-hydraulics. And, in addition, there is the greater cleanliness and employee comfort, greater operating flexibility and 24-hour-a-day availability.

Interested in cutting your track haulage costs? Then write today! We'll be glad to analyze your problem . . . show how a Baldwin locomotive can give substantial savings over your present power.

Baldwin-Lima-Hamilton Corporation
Philadelphia 42, Pa.
Offices in Principal Cities

A COMPLETE LINE!

Baldwin builds a complete line of Diesel-hydraulic, Diesel-electric and Diesel-mechanical locomotives for railroad, industrial and mining applications. Diesel-hydraulics from 12 to 35 tons, Diesel-electrics from 25 to 95 tons, and Diesel-mechanicals in 5 and 8 tons.

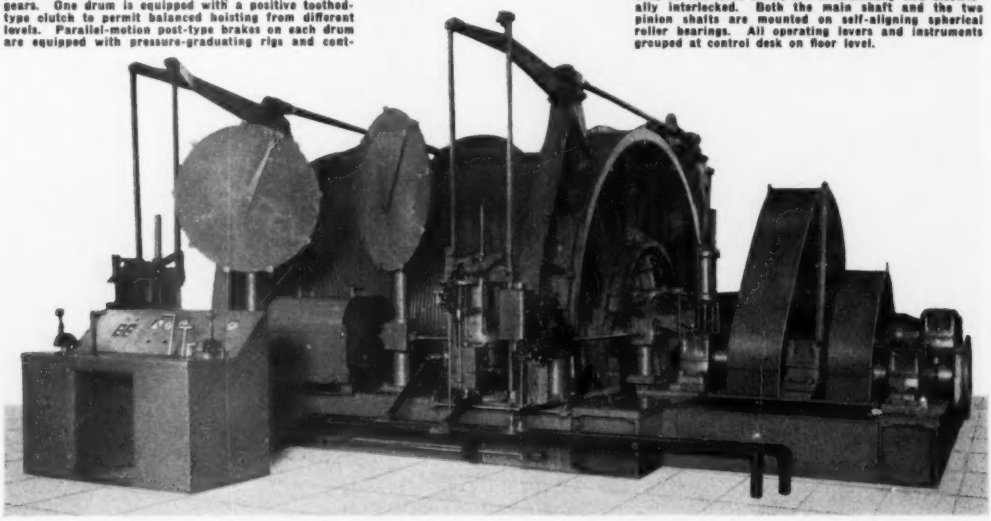
Every Baldwin locomotive reflects the pioneering engineering that gave industry the first gasoline locomotive, as well as the first explosion-proof, electric storage battery locomotive.

BALDWIN · BLH · LIMA-HAMILTON

BALDWIN - LIMA - HAMILTON

Shop assembly of very modern shaft hoist recently furnished to a metal mine in Australia. 12'—0" x 51" "built-up" all-steel cylindrical drums will be driven by a 600 hp. direct-current motor, with Ward-Leonard amplidyne control, through double-reduction herringbone gears. One drum is equipped with a positive toothed-type clutch to permit balanced hoisting from different levels. Parallel-motion post-type brakes on each drum are equipped with pressure-graduating rigs and controlled by modern safety devices which include man-safety feature and automatic throttle shut-off which prevents over-speeding at any point of travel. Brakes and clutch are both operated by oil-hydraulic engines and, on the loose drum, are mechanically and electrically interlocked. Both the main shaft and the two pinion shafts are mounted on self-aligning spherical roller bearings. All operating levers and instruments grouped at control desk on floor level.

FOR AUSTRALIA



All Over the World
VULCAN HEAVY-DUTY HOISTING EQUIPMENT
is helping free nations to develop their resources

Each of these three bulletins contains a wealth of specific information. Write for free copies if you can use them to advantage. Fully illustrated.

In this period of international cooperation, when all free nations are striving to increase their ability to resist aggression, we are proud of the important services being rendered by Vulcan engineers and Vulcan products to mining companies throughout the free world.

Coal, Copper, Iron, Lead, Zinc, and many other essential materials are being produced in greater volume today than ever before by the aid of Vulcan Hoists, Sheaves, Cages, Skips, and other heavy-duty hoisting equipment. The modern hoist illustrated and described above is only one of many recently built, or on order, to assure still greater production in the near future.

Write us regarding any present or prospective hoisting requirement. Our engineers welcome opportunities to make helpful suggestions—based on more than a hundred years of successful experience.

Vulcan Iron Works

ESTABLISHED 1849

Cable Address "Vulworks, Wilkes-Barre"

WILKES-BARRE, PA.

New York City Office, 50 Church Street

DESIGNERS AND BUILDERS OF ELECTRIC HOISTS, CAGES, SKIPS, SHEAVES, ETC., CONVEYORS, ROTARY KILNS, DRYERS, ETC., AND ALL TYPES OF MINING LOCOMOTIVES

SEE OUR FOUR-PAGE INSERT IN THE McGRAW-HILL MINING CATALOGUES.

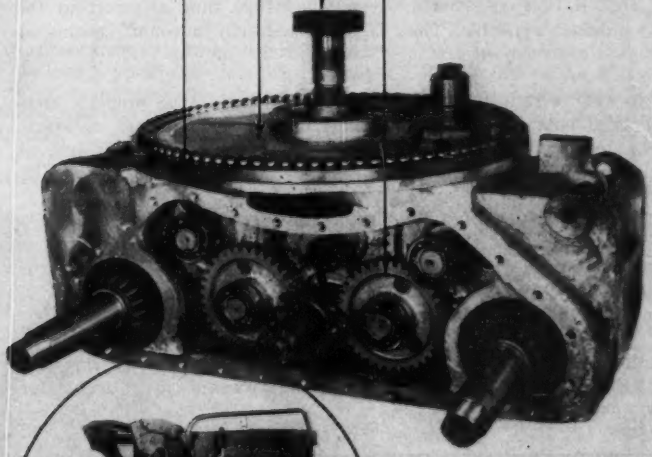
WHAT ALLOY STEEL CASTINGS* MEAN IN UNDERGROUND LOADING MACHINES

The structure of steel castings is uniform for greater strength, shock and stress resistance.

In steel castings the metal is distributed where it will do the most good—for maximum strength and minimum weight.

High rigidity, minimum deflection, accurate alignment, close tolerance and better fit are all inherent characteristics of steel castings.

Steel castings have high fatigue resistance, maximum endurance and longer life—ideal qualities for critically stressed parts.



Model 21 Eimco Lower Deck

Model 21 Eimco

***All EIMCO Loaders are built with alloy steel parts throughout. This is an exclusive EIMCO feature.**

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

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IN FRANCE, SOCIETE EIMCO, PARIS, FRANCE
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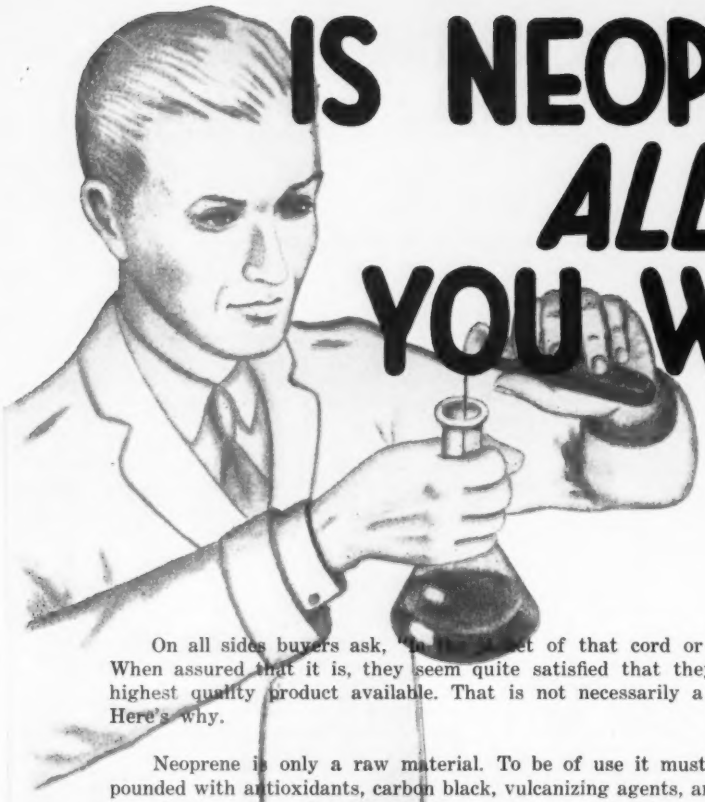
IN ITALY, EIMCO ITALIA, S.P.A., MILAN, ITALY

IS NEOPRENE ALL YOU WANT ?



On all sides buyers ask, "Is it neoprene?" When assured that it is, they seem quite satisfied that they are getting the highest quality product available. That is not necessarily a sound conclusion. Here's why.

Neoprene is only a raw material. To be of use it must be **properly** compounded with antioxidants, carbon black, vulcanizing agents, and other materials. In other words, technical skill in properly compounding neoprene is just as important as using neoprene itself.

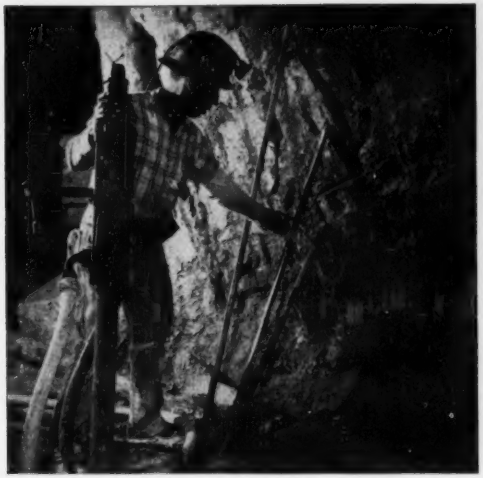
TIREX Cords and Cables were the first to be made in this country with a heavy duty jacket. Proof of the fact that compounding skill is important is shown by the fact that in the intervening thirty years TIREX has kept the leadership in the field of portable cords and cables. Simplex skill developed the cords and then kept them leaders against all comers.

The next time you need a portable cord or cable specify and be sure you get Simplex-TIREX Cords and Cables. The name is embossed on the jacket for your protection.

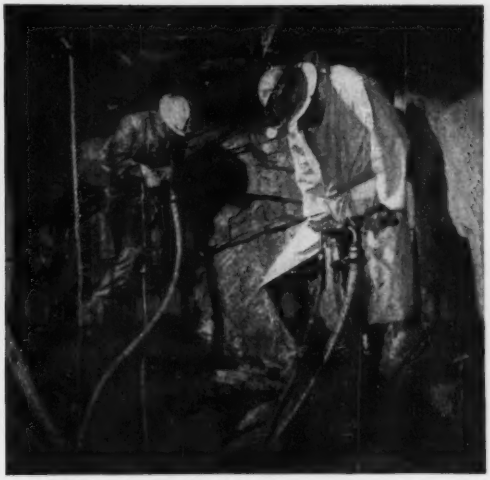
SIMPLEX-TIREX IS A PRODUCT OF SIMPLEX RESEARCH

SIMPLEX TIREX

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.



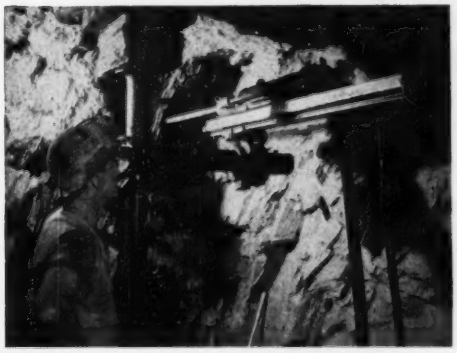
Stopers at Iron King use 1-in. quarter-octagon alloy hollow drill steel. Much of the mining here is done by cut-and-fill stoping. Lead and zinc are the principal metals produced.



Jackhammers come in handy at Iron King for a variety of drilling work. Bits and rods are reconditioned at the mine. Nearly 1½ million tons of ore have been mined here since 1906.

Drilling the stubbornest ore in Arizona

Operating men at the Iron King mine of Shattuck Denn Mining Corporation believe the rock they drill is tougher and more abrasive than any other in the state. The ore at this property, near Humboldt, Ariz., is a cherty, fine-grained sulfide. Some of it is so stubborn that ordinary steel bits will penetrate only one inch before becoming dull.



This drifter bores 7-ft holes into tough sulfide ore with 1¼-in. round Bethlehem alloy rods and carbide insert bits.

Fortunately it's not all quite that hard to drill. But because of the difficult drilling conditions, the mine management has made extensive tests of both bits and rods. This development work led Iron King to adopt carbide insert bits on rods of Bethlehem alloy drill steel.

This combination has made possible increased production at lower cost per ton. Previously they used conventional bits on carbon drill steel rods. Bethlehem hollow drill steel is used exclusively at Iron King because, in the words of H. F. Mills, manager, "it's the best of the steels we've tried."

Opened in 1906, Iron King is principally a lead and zinc producer. Some gold and silver are also recovered from the complex sulfide ores. Production currently totals about 17,000 tons monthly on a two-shift schedule.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL

BETHLEHEM STEEL

DR34 feed and H23DR drill mounted on truck chassis. Note that Le Roi-AIRMASTER compressor is also mounted on chassis, to supply plenty of low-cost air.

Uranium operation gets remarkable performance from LE ROI-CLEVELAND AIR FEED and H23DR DRILL

HOLES as deep as 120 feet drilled with sufficient air for hole cleaning! 18 feet of hole in 12 to 14 minutes, with 90 to 95 psi air pressure. Mister, that's real drilling! And it's typical of the money-making performance you get with Le Roi-CLEVELAND rock drills.

The DR34 air-feed shell provides a 21′ feed with 20′ steel change. The drill is a Le Roi-CLEVELAND 80-lb. H23DR with 5/16″ blowing, strong rotation, positive valve action, plenty of wallop, and dependable durability. Chuck size is standard — 1″ hex, 4-1/4″ shank. Octagon or round-lug shanks can be used, also.

Though 120′ holes have been sunk in uranium-prospect drilling operations — using jointed steels and standard forged steel-type detachable bits with stellited corners — average drilling depth with the DR34 for blast holes is 40′ to 50′, depending on the contour of the terrain.

On deep-hole work, enjoy more footage per shift — do your drilling better, faster, for less — with Le Roi-CLEVELAND machines.

Write today for complete information.

LE ROI COMPANY

RD-48

CLEVELAND ROCK DRILL DIVISION
12500 Berea Road, Cleveland 11, Ohio
Plants: Milwaukee, Cleveland and Greenwich, Ohio

SAVE MONEY

ON EVERY TRIP

YOUR SCRAPER MAKES

WITH THE GARDNER-DENVER

AIRSLUSHER

HERE'S HOW:

Steady power—for a full pay load every trip.

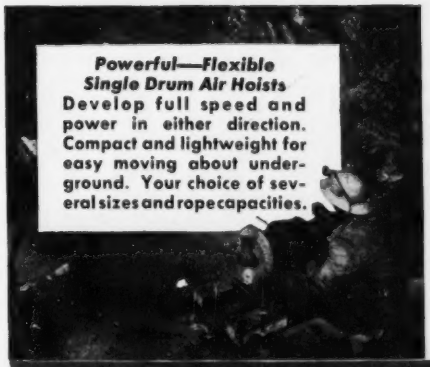
High speed—for more trips per shift.

No air-waste idling between trips.

Single throttle control—readily mastered by your new miners.

Three sizes—to fit your scraper capacity efficiently.

Write today for Bulletin AS-3 on Gardner-Denver Airslushers and Air Hoists.



Powerful—Flexible Single Drum Air Hoists
Develop full speed and power in either direction. Compact and lightweight for easy moving about underground. Your choice of several sizes and rope capacities.

SINCE 1859

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada:
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THE QUALITY LEADER IN Compressors, Rock Drills and Hoists

Cut drilling costs with THROWAWAY Bits...

Save Steel
Save Powder

1 Easily deformable skirt permits quick removal of bit from shank. No lost time with stuck bits.

2 Ample chip clearance allows faster drilling.

3 Short reaming sides eliminate sticking and allow close gauge following.

4 Blunt non-breaking cutting edges have self-sharpening tendency . . . are uniformly tempered hard, biting steel.

5 Large hemispherical non-plugging water outlet.

6 Lathe-cut, ground or forged parallel shank fits firmly into close tolerance bit socket. No threads required. Perpendicular socket wall allows shank to bottom in bit for maximum performance.

7 Perfect uniformly treated bit teeth assure best possible cutting power and smooth operation.

LOWER your drilling costs with smaller holes and faster drilling. Bottom with 1¼ inch holes and save costly steel and powder. Let us prove to you that the man at the drill can do more work for less cost with a Throwaway Bit. Write for new low price list and technical description of Throwaway Bit to: Portland, Oregon home office or distributors listed below. Competent field engineers and dealers are always at your service.

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CREATING ENGINEERING
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GREENAWALT-WHEELOCK & CO.
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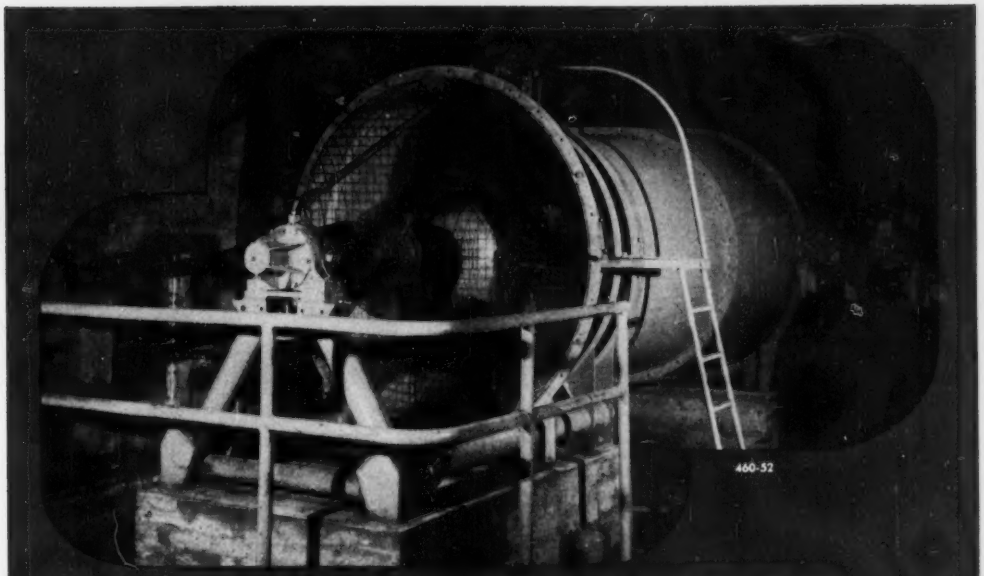
El Paso, Texas



EFFICIENT VENTILATION

gives added impetus to underground production

JEFFREY FANS

FRESH AIR underground is essential to maximum production. Jeffrey knows this from their long experience in solving hundreds of varied ventilation problems in all types of underground workings.

To keep up with and successfully meet the demands of modern mining, Jeffrey maintains a continuous program of development of aerodynamic and constructional improvements. Included in this program is a fan test laboratory, fully equipped with the most advanced instruments and facilities for rapid, accurate testing of new designs plus service tests of fan components.

Illustrated is a 12 A 58 Aerodyne Fan installation at the U. S. Potash Co., Carlsbad, N. M. This is only one of many similar installations in the metal and non-metallic mining field. This model fan is designed for 13″ W.G. maximum pressure and volumes up to 600,000 c.f.m. It features internal self-circulating oil lubrication and separate ball thrust bearing. All fan installations are engineered to meet operating requirements.

Be sure to consult a Jeffrey Engineer on your ventilation problems.

THE JEFFREY MANUFACTURING COMPANY

Established 1877

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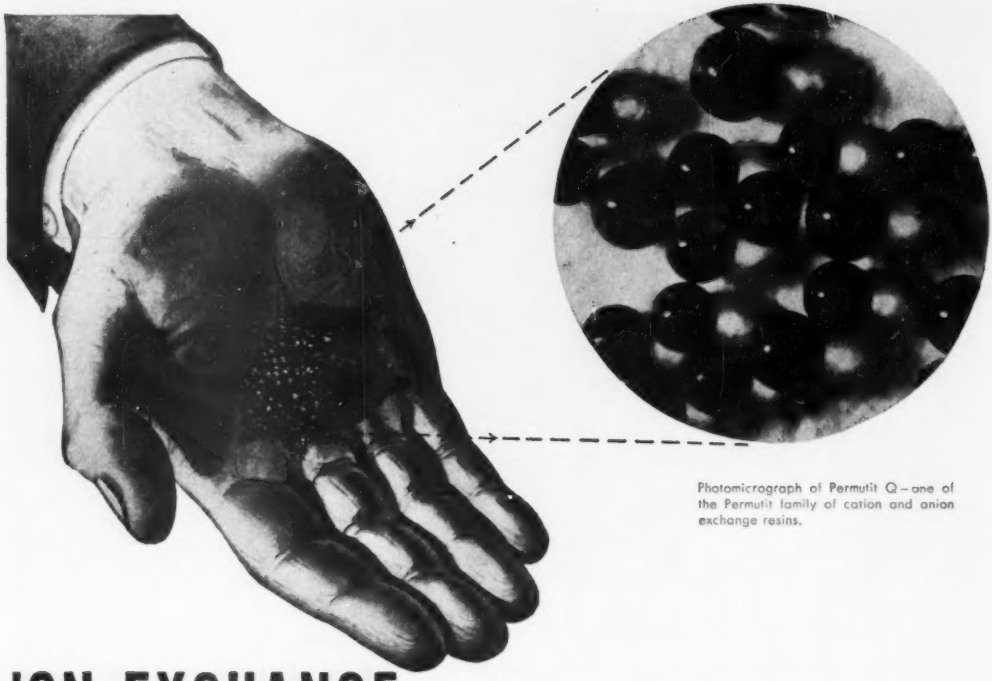

Photomicrograph of Permutit Q—one of the Permutit family of cation and anion exchange resins.

ION EXCHANGE

—new tool for Wet Process Metallurgy

Have you ever thought of putting ion exchange resins to work . . . of developing new processes that will pave the way to quantity recovery of valuable metals from ores now considered wastes because of the limitations of conventional techniques?

Ion exchange holds great promise of revolutionizing existing methods of concentration, purification and separation. The roster of metals with ores amenable is long and impressive . . . includes copper, tungsten, vanadium, molybdenum, gold and silver.

With over forty years of experience in ion exchange, Permutit has worked on all types of problems. Most of the ion exchange processes now in use were developed, designed, and manufactured by Permutit . . . often in cooperation with the industries which have adopted the processes.

Permutit is ideally equipped to cooperate with your engineers in developing ion exchange techniques to meet your specific requirements. Remember, Permutit is the only manufacturer of all types of ion exchangers . . . both resins and equipment. This assures undivided responsibility for the specification,. design, manufacture and performance of both equipment and resins, tailor-made to your requirements.

For further information, write to: THE PERMUTIT COMPANY, DEPT. EMS-11, 330 WEST 42ND STREET, NEW YORK 36, NEW YORK; or Permutit Company of Canada, Ltd., 6975 Jeanne Mance St., Montreal.

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"We pay more for Homocord, but it costs us less!" • That's what users say . . . and they won't take any other conveyor belt. It makes sense, too. Where tonnage is toughest, Homocord has been known to outlast 2 or 3 ordinary conveyor belts. Figure cost of belts, plus cost of repeated installations, and Homocord proves the biggest bargain you can get • Its special construction—cushioned and flexible—absorbs impact that other belts can't take. Send for Bulletin 6906 and read about the Guillotine Test that proves our point • The same engineering goes into our hose, V-belts and flat belts. Get your Manhattan representative to show you.

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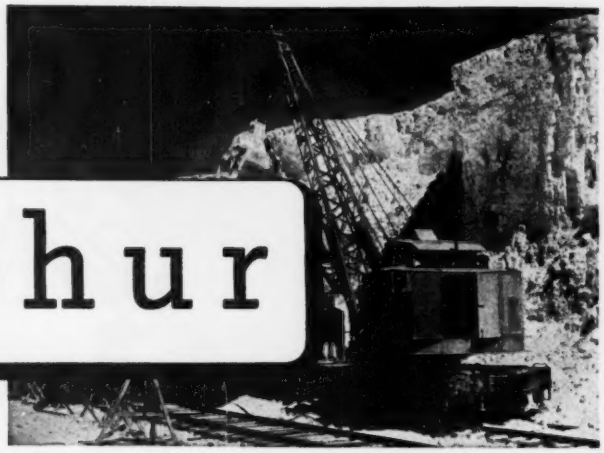
Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Packings • Brake Linings • Brake Blocks Clutch Facings • Asbestos Textiles • Sintered Metal Parts • Bowling Balls



Sulphur

Thousands of tons mined daily, but where does it all go?

Did you ever have the misfortune on a steaming, sticky, sultry day to sit it out on a crowded parkway, bumper to bumper, waiting for traffic to clear? No doubt your thoughts were plenty sulphurous but probably not along the lines we have in mind.

We're thinking of the mineral Sulphur and its link with the automobile. Each car accounts for a substantial poundage of Sulphur, some estimates put it at around 25 pounds for the average car. Give or take 5 pounds, it shows that a tremendous tonnage of Sulphur is needed each year to put cars, buses and trucks on the road ready to operate. And don't forget the tire and battery replacements going on every day.

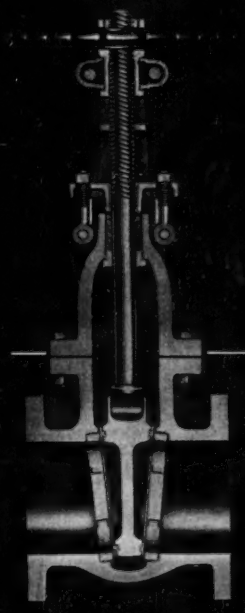
Sulphur enters the automobile picture through the tires, steel sheets, plated and plastic fittings, glass, battery acid and parts, copper tubing and wiring . . . all of which call for the use of Sulphur or its compounds in connection with their manufacture.

Can you wonder that Sulphur goes into industry just about as fast as the sulphur producers of the Gulf Coast Region can get it above ground and cooled preparatory to shipment?

Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.

Sulphur Producing Units: Newgulf, Texas • Moss Bluff, Texas
Spindletop, Texas • Worland, Wyoming



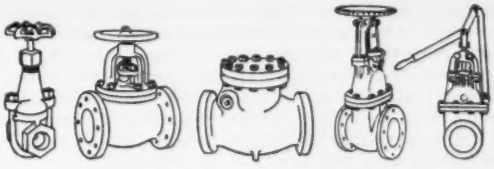
IRON

COMPLETE LINES OF IRON VALVES AND PIPE FITTINGS are manufactured by Walworth in a variety of types, pressure ratings, sizes, and patterns for general industrial use.

Walworth also manufactures complete lines of valves (including Lubricated Plug Valves), and pipe fittings made of steel, bronze, and special alloys.

These valves and pipe fittings, plus Walworth-made pipe wrenches total approximately 50,000 items and are sold through distributors in principal centers throughout the world.

Walworth engineers will be glad to help you with your problems. For further information call your local distributor, nearest Walworth sales office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, New York.



Iron valves in gate, globe, angle, check, and lubricated plug types are manufactured by Walworth. Illustrated is a sectional view of a Walworth No. 726F Standard Iron Body, Bronze Mounted, Wedge Gate Valve with flanged ends. This line of valves is available in sizes 2 to 30 inches. Similar valves of All-Iron type are also available.

WALWORTH

Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

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DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

ANNOUNCING THE NEW LORAIN SCOOP SHOVEL

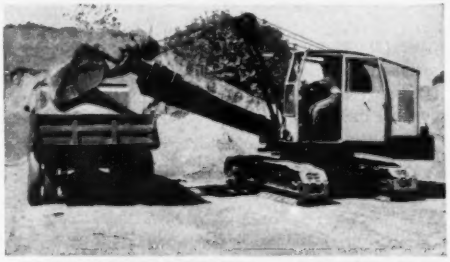
SCOOP OF THE YEAR

Here is a new, revolutionary, high-speed loading tool for mines, pits and stockpiles! It's the LORAIN SCOOP SHOVEL, a new front end attachment for the popular Lorain TL-25 "Series". This new front-end loader eliminates the *travel* phase of the loading cycle. The *turntable swings a full 360°* to dig and dump — no travel movement is required. With its extra-long reach of *24* feet, the Scoop Shovel can work a wide radius with no crawler motion. The job can be "cleaned up" easily — trucks can move in close for efficient, time-saving loading. And— the Scoop Shovel can load on the down-grade, on the level and on up-grade. Standard bucket capacity is 1-1/4 cu. yd. and the bucket can lift to a dumping height of 14 feet to load into the largest hauling units. Operator visibility is at its very best.

Investigate this NEW method of high speed loading that gives you the EXTRA advantages of complete convertibility to all five other front ends.

THE THEW SHOVEL CO., LORAIN, OHIO

LOW HEIGHT is ideal for low headroom operations, such as this underground mine where the Scoop Shovel is shown loading a hauling unit. Note how the bucket is extended on the telescopic boom to "reach out" to the wagon.



NEW HAVEN TRAP ROCK CO., New Branford, Conn. loads trucks in record time because of big bucket capacity and fast action of their Lorain TL-25K Scoop Shovel. Note excellent operator visibility and accurate load spotting.

ATTENTION: LORAIN TL-25 OWNERS . . . The new Scoop Shovel can be attached to your present machine, quickly and easily. And you can reconvert to other front-ends at any time. Ask your Thew-Lorain Distributor for the story.

THEW LORAIN

WHEN DIGGING'S TOUGH, THIS DIPPER'S TOUGHER

How service and manganese steel are cast and welded into **AMSCO** Dippers

More than 5,000,000 cubic yards of rock and abrasive materials have been dredged by one AMSCO All-Manganese Steel Dipper similar to this 1¾-yard model —and the end of its service is nowhere in sight!

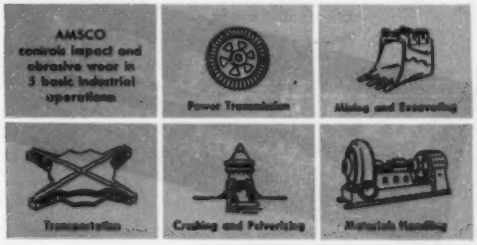
Service like this is expected—and considered normal—by users of AMSCO Dippers. Just as users throughout all industry know that AMSCO Manganese Steel Products mean service and long life wherever impact and abrasion must be controlled. AMSCO Manganese Steel has the unique quality of actually becoming harder with use, acquiring a high surface polish to shrug off grinding abrasion, while retaining body metal toughness.

Made *entirely* of "The Toughest Steel Known," AMSCO Manganese Steel Dippers use no rivets, but are fabricated by the modern, streamlining Plug-Welding method that permanently interlocks cast segments. AMSCO All-Manganese Steel Dippers are available in two-piece welded, three-piece renewable lip, and Missabi designs—or can be adapted to your unusual materials handling specifications. Also available in sizes to fit all power shovels.

Check these additional PLUS features:

- **One-piece Manganese Steel back casting.**
- **Top and bottom have cast-in, double-wall box-sections for maximum strength, minimum weight.**
- **Cast-in pin connecting lugs for handle, back, braces, bail.**
- **Bail is a one-piece casting with elongated tubular cross-section, for strength and lightness.**
- **Teeth are set for clean, fast digging.**
- **Interior is smooth and slightly tapered for free dumping.**

Contact your shovel manufacturer about AMSCO Dippers, or write AMSCO, Chicago Heights, Illinois.



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AMERICAN MANGANESE STEEL DIVISION

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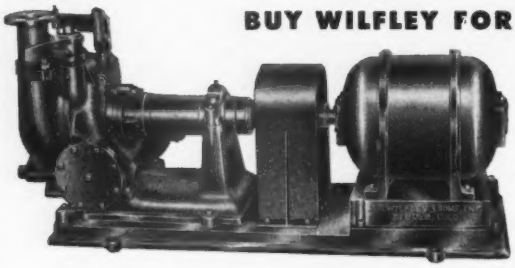
Foundries at Chicago Heights, Ill.; New Castle, Del.; Denver, Colo.; St. Louis, Mo.; Los Angeles, Calif.
Offices in principal cities. In Canada: Joliette Steel Limited, Joliette, Quebec.

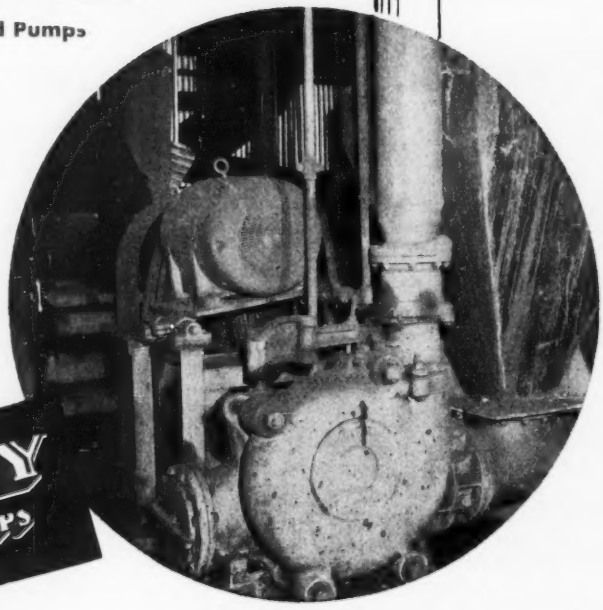
heavy media

BUY WILFLEY FOR COST SAVING PERFORMANCE



Companion to famous Wilfley Acid Pumps

This Wilfley Model K *pump is extremely effective in heavy media circuit and thickener circuit work in coal washing operations. Specifically designed for rugged, heavy duty performance, delivering continuous, trouble-free operation at low cost without media loss, leakage or dilution.*



WILFLEY centrifugal PUMPS

In modern plants all over the world dependable, highly efficient Wilfley pumps are on the job, operating 'round-the-clock without attention. Available in sizes that meet every pumping requirement. Individual engineering on every application... Write or wire for complete details.

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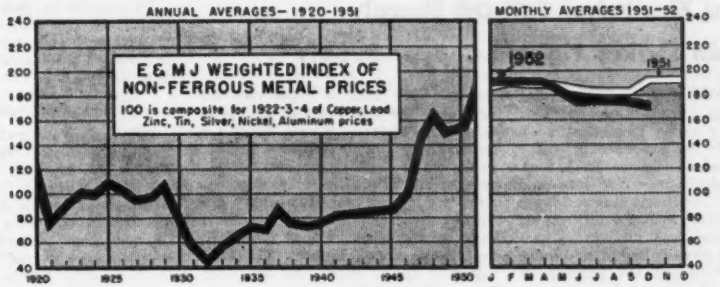
E&MJ OUTLOOK

PRICES



MARKETS

The decline, during the month, of lead from 16¢ to 13½¢, and of zinc from about 14¢ to 12½¢, brought the *E&MJ* index of nonferrous metal prices down to 173.85 for October from September's 178.59.

Zinc's outlook, bleak as October ended, warms up somewhat with returning strength in lead. Probability of better control of the London Metal Exchange's lead dealings, as applied to U.K. Government stocks, brings hope that trading in zinc after Jan. 1 won't unsettle the U.S. market.

Lead's prospects are stronger. The London market is firming up and there's some hope of action to take the pressure of foreign lead off U.S. markets. This may benefit zinc as well. Copper, meanwhile, booms along, and a price increase through OPS action is a possibility.

•

LABOR

Mine, Mill's leaders are worried about those charges of Communist influence made at Salt Lake. It could lead to another rank-and-file revolt. Meanwhile, peace is declared on the nonferrous labor front.

•

AT HOME

Government spending, main prop of the business boom, isn't likely to be affected much by the election, at least not downward. Commitments already made should keep money flowing in 1953 at 1952's level.

Capital investment by the mining industry should be higher in 1953 than in 1952. It's hard to see how metals, even zinc, could fail to hold a good level of demand if business is as good through 1953 as it looks right now.

Even if the U.S. eventually decides **the atom bomb stockpile** is big enough, it won't cut demand for uranium. Within two years, every major mining company will probably be in the uranium business.

Look for a drop in price, and some new processes, for titanium metal within a year or so. Kennecott's among the leaders in this race.

Chemical Construction Corporation's new cobalt leaching process is producing metal in Howe Sound's plant at Salt Lake, trouble with accessory equipment having been overcome.

•

ABROAD

The value of foreign holdings in Bolivia's "Big Three" tin companies, nationalized Oct. 31, equals a fraction, says the government, of the $520.5-million Bolivia claims they owe in back taxes.

West Indies Mining Corp. (*E&MJ*, Aug. 1952), the Puerto Rican iron mine, hopes soon to ship ore from its new Santo Domingo holdings.

The DPA contracted recently for 77-million lb. of aluminum from Canadian and British producers for 1953 delivery. This doesn't increase U.S. supply, only replaces output lost by power shortage in the Northwest.

Newmont Mining Co. has had exploratory talks on a matte-smelting process in Japan for New Caledonian nickel ores. No deal as yet.

MARKETS—Trends and Prices

Lead and Zinc Prices Fall Off Sharply

Rhodesian Strikes Tighten Copper Supply

OCTOBER WAS A BAD MONTH for the high-cost, small-mine operator who in many cases cannot stay in business when the combined price for lead and zinc drops below 30¢. Actually, the combined price for lead and zinc on a St. Louis basis slumped from 29.325¢ on Oct. 1, to 25.80¢ on Oct. 31. Mine shutdowns and production curtailment have already begun, and more are feared. Although the position of lead in the U.S. market is not weak, fear of dumping of British lead on world markets at low costs as indicated in the course of resumed trading in lead on the London Metal Exchange has had its impact on domestic prices. Similarly, offerings of foreign zinc superimposed upon accumulated stocks due to the steel strike have contributed to the drop in zinc prices.

Lead Takes Three Sharp Cuts

Domestic lead suffered three drastic cuts during October, bringing the price down from 16¢ per lb. on Oct. 6 to 13.5¢ on Oct. 22. This decline was directly related to sharp drops on the London Metal Exchange where trading in lead was resumed on Oct. 1. Consumers realizing that large stocks in the hands of the British Ministry of Materials were likely to find substantial release through free trading channels, naturally held back, and as a result the opening price of £111 per long ton equivalent to about 13.9¢ soon tumbled. Successive drops brought the L.M.E. price down to a low of £80 on Oct. 22, equivalent to 10¢; or 12¢ N.Y., duty paid.

Potential dumping by the British Ministry, contributing to an unnatural weakness in the world market, was reflected in action taken by domestic sellers who, encountering buying resistance, lowered prices successively to encourage a normal flow of lead and an orderly market. Actually, domestic stocks in the hands of both producers and consumers are on the low side and warrant no such weakness as the October price drop seems to indicate.

As the month closed, sales volume was heavy, and November promises to be as good as October on the basis of orders booked.

Zinc Oscillates Downward

Zinc prices started the month off by bobbing up and down between 13½¢ and 14¢ for about a week, finally settling down to 13½¢ for two weeks, only to start acting up again on Oct. 23 when another short struggle took place between the 13½¢ and 12½¢ level. All of this irritated consumers because they had to make out new price lists for their lines of zinc products, etc. and found it very difficult to do business. The fluctuations might be explained by the fact that most sellers recognized a weakness in the zinc market due to a plentiful supply, but the degree of weakness was considered to be greater by some than others. As the month closed, buying interest in zinc was spotty depending on inventory position of the buyer.

Probable resumption of zinc trading on the London Metal Exchange early next year in the face of large metal holdings by the Ministry of Materials has caused some uneasiness in domestic market circles, where it is feared that zinc may follow the pattern of lead trading when it was resumed.

Copper Still Tight

Pressure for a higher domestic price for copper continued strong all the month. Early in October the Copper Producers' Advisory Committee met with the NPA in Washington and called for decontrol of copper. OPS spokesmen gave little hope for such a move, but promised to hold a meeting "later" at which representatives of the copper industry could give their views on the muddled copper price situation.

As October ended, the copper market was tight as a drum. Consumers, recognizing a bargain, were rushing to buy metal at the domestic price of 24½¢. All the available foreign copper was also taken up, although the U.S. was the only market through the month for Chilean copper at the 36.15¢, f.a.s. N.Y. price. European consumers had lost interest in this high-priced metal some time ago.

However, a strike of employees at the copper mines in Northern Rhodesia, which began Oct. 20 and was still on at the month's end, threatened to unsettle the world market once more. Britain, soon after the strike began, was inquiring for copper elsewhere for fourth quarter delivery, apparently being hard-pressed for the metal. It looked as if this development might increase demand for Chilean copper, unless the Rhodesian strike were settled quickly.

The situation was further complicated by a shutdown for repair of one reverb at Kennecott's Hurley, N.M. smelter, which deducted about 1,300 tons from the November NPA allocations. This, plus the failure of some new production to materialize on schedule, both in the U.S. and abroad, further tightened the copper market, which ended the month on a definitely stronger tone.

Shipments to fabricators in September set a new high for the year of 134,689 tons, although consumption by fabricators totaled 122,943 tons of refined copper.

Bolivia Nationalizes Mines

RFC sales dominated the domestic tin market early in the month, totaling about 800 tons per week, but this volume declined to 40 to 80 tons per week as the month closed. Increasing quantities of tin were available on the "outside market" during the last half of October, but trading prevailed on the dull side. RFC's $1.21½¢-per-lb. price was the going price during October, but it is quite likely that the volume of "outside" sales will pick up sufficiently during November to influence or determine the tin price quotations.

Average Prices for October (E&MJ Quotations)

Copper:	
Electrolytic, domestic, refinery	24.200
Electrolytic, export, refinery	34.751
Lead:	
Common, New York	14.404
Common, St. Louis	14.204
Silver and Sterling Exchange:	
Silver, New York, per oz.	83.250
Silver, London, pence per oz.	73.000
Sterling Exchange, "Checks"	279.406
Zinc:	
Prime Western, East St. Louis	13.297
Tin:	
New York Straits	121.500
New York, 99% min. (e)	120.500
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	191.000
Antimony (E&MJ) (d)	42.470
Antimony, bulk, Laredo	39.000
Antimony, in cases, Laredo	39.500
Platinum, refined, per oz.	90.000
Cadmium (a)	200.000
Cadmium (b)	207.500
Cadmium (c)	215.000
Aluminum, 99% plus, ingot	20.000
Magnesium, ingot	24.500
Nickel (f)	56.500

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lbs.

(a) Cadmium average based on the producers' quotations.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lot, packed in cases, f.o.b. New York.

(e) Tin content.

(f) F.o.b. Port Colborne, U.S. duty included.

Markets Continued on Page 104

All eyes were on Bolivia where formal nationalization of the Patino, Hochschild, and Aramayo properties took place Friday, Oct. 31. This day was declared a holiday heralding Bolivia's "economic freedom." The already bleak outlook for the above-mentioned companies was further darkened by charges totaling some $520-million which were levied against them by Boliva for alleged violations of exchange regulations and for non-payment of taxes and duties. This amount is equivalent to the value of Bolivia's tin output for six to seven years. Provisional indemnities to be paid to the tin companies are reportedly $21 million.

"Free" Gold Market

The free gold market has become slightly firmer during October. Trading volume increased approximately 20% over that for September. The coin market was partially disturbed by heavy offers of privately-minted sovereigns which sell at a rebate of 8% to 10% against gold and genuine coins. "Pick's World Currency Report" quotes per fine ounce, as follows:

	COINS		BARS (12.5 kg.)	
	Sept. 30	Oct. 31	Sept. 30	Oct. 31
NEW YORK, transit	.....	.....	$37.30	$37.35
MANILA	$48.00	$47.50	36.85	37.30
HONG KONG	47.85	47.50	40.75	40.75
BOMBAY	49.55	49.00	46.00	45.50
TANGIER	50.50	50.75	37.35	37.55
BEYROUTH	50.63	50.00	37.40	37.80
PARIS	50.25	50.50	38.75	39.10
BUENOS AIRES	46.00	47.00	40.75	40.75

Major Metals

U. S. DAILY AND AVERAGE PRICES

Oct. 1952	Electrolytic (a) Domestic	Copper (b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
1	24.200	34.925	121.500	16.000	15.800	13.525
2	24.200	34.650	121.500	16.000	15.800	13.525
3	24.200	34.650	121.500	16.000	15.800	13.700
4	No Market	34.025	121.500	16.000	15.800	14.000
6	24.200	34.900	121.500	16.000	15.800	13.625
7	24.200	34.500	121.500	15.000	14.800	13.600
8	24.200	34.575	121.500	15.000	14.800	13.500
9	24.200	35.125	121.500	15.000	14.800	13.500
10	24.200	34.975	121.500	15.000	14.800	13.625
11	No Market	34.250	121.500	15.000	14.800	13.500
13	Holiday	34.225	Holiday	Holiday	Holiday	Holiday
14	24.200	35.075	121.500	14.000	13.800	13.500
15	24.200	34.825	121.500	14.000	13.800	13.500
16	24.200	34.900	121.500	14.000	13.800	13.500
17	24.200	34.925	121.500	14.000	13.800	13.500
18	No Market	34.700	121.500	14.000	13.800	13.500
20	24.200	35.000	121.500	14.000	13.800	13.500
21	24.200	34.750	121.500	14.000	13.800	13.500
22	24.200	34.900	121.500	13.500	13.300	13.500
23	24.200	35.075	121.500	13.500	13.300	13.125
24	24.200	34.900	121.500	13.500	13.300	13.000
25	No Market	34.300	121.500	13.500	13.300	13.000
27	24.200	35.225	121.500	13.500	13.300	12.500
28	24.200	34.900	121.500	13.500	13.300	12.500
29	24.200	34.850	121.500	13.500	13.300	12.500
30	24.200	34.525	121.500	13.500	13.300	12.500
31	24.200	34.625	121.500	13.500	13.300	12.500
	AVERAGES FOR MONTH					
Oct.	24.200	34.751	121.500	14.404	14.204	13.297
	AVERAGES FOR WEEK					
Oct.						
1	24.200	34.904	121.500	16.000	15.800	13.692
8	24.200	34.550	121.500	15.667	15.467	13.658
15	24.200	34.746	121.500	14.600	14.400	13.525
22	24.200	34.863	121.500	13.917	13.717	13.500
29	24.200	34.875	121.500	13.500	13.300	12.771
	CALENDER WEEK AVERAGES					
Oct.						
4	24.200	34.675	121.500	16.000	15.800	13.717
11	24.200	34.721	121.500	15.167	14.967	13.558
18	24.200	34.775	121.500	14.000	13.800	13.500
25	24.200	34.821	121.500	13.667	13.467	13.271

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent. Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc, to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingotbars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West, effective Jan. 1, 1951, commanded a premium of 1.35c. per pound over the current market for Prime Western; Special High Grade 1.50c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and fractions of a cent per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, as reported daily by regular suppliers, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance to such suppliers for carrying, delivering and marketing. In addition to foreign silver, the quotations also apply to domestic silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver is 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

October 1952	Sterling Exchange "Checks"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
1	278.5000	83.250	73.000d.	248s.	$35.00
2	279.0000	83.250	73.000d.	248s.	35.00
3	279.0000	83.250	73.000d.	248s.	35.00
4	(e)	(e)	(e)	(e)	35.00
6	279.0000	83.250	73.000d.	248s.	35.00
7	279.0000	83.250	73.000d.	248s.	35.00
8	279.0000	83.250	73.000d.	248s.	35.00
9	279.0000	83.250	73.000d.	248s.	35.00
10	279.0000	83.250	73.000d.	248s.	35.00
11	(e)	(e)	(e)	(e)	35.00
13	Holiday	Holiday	73.000d.	248s.	Holiday
14	279.0000	83.250	73.000d.	248s.	35.00
15	279.0000	83.250	73.000d.	248s.	35.00
16	279.7500	83.250	73.000d.	248s.	35.00
17	279.7500	83.250	73.000d.	248s.	35.00
18	(e)	(e)	(e)	(e)	35.00
20	279.7500	83.250	73.000d.	248s.	35.00
21	279.7500	83.250	73.000d.	248s.	35.00
22	279.7500	83.250	73.000d.	248s.	35.00
23	279.6250	83.250	73.000d.	248s.	35.00
24	279.5625	83.250	73.000d.	248s.	35.00
25	(e)	(e)	(e)	(e)	35.00
27	279.6875	83.250	73.000d.	248s.	35.00
28	279.8125	83.250	73.000d.	248s.	35.00
29	279.8125	83.250	73.000d.	248s.	35.00
30	280.1875	83.250	73.000d.	248s.	35.00
31	280.0000	83.250	73.000d.	248s.	35.00
	AVERAGES FOR MONTH				
Oct.	279.406	83.250	73.000d.	—	35.00
	AVERAGES FOR WEEK				
Oct.					
1	278.513	83.250	—	—	—
8	279.000	83.250	—	—	—
15	279.000	83.250	—	—	—
22	279.750	83.250	—	—	—
29	279.700	83.250	—	—	—

Calendar week averages, New York Silver: Oct. 4th, 83.250; 11th, 83.250; 18th, 83.250; 25th, 83.250.

(e) No Market (Saturday).

Behind the By-Lines . . .

G. P. Lutjen

A long time ago, about the time we got our last raise, we began hearing a lot about Ion Exchange. It seemed from the reports, that an Ion Exchanger could do anything from mixing homebrew to shrinking heads. In the July, 1951, issue, we pinned it down a little more closely than that, but felt that more should be said to do justice to the subject and its relation to mining. So a few months ago we climbed to the fifth floor of the School of Mines at Columbia University, made our way past a small horde of Columbia students waving Taggart Handbooks and slide rules, and knocked at the door of Prof. Nathaniel Arbiter. "Prof.," we said in effect, "What's with this ion exchange?"

One summer and a few phone calls later, we had just the manuscript we wanted; a straightforward story on ion exchange in plain language. It's all on pages 80 to 85: what ion exchange is; how it works; why it works; what it can and cannot do in beneficiating and refining metals. A few minutes of your reading time will bring you up to date on this important new process.

It wasn't just chance that led us to Prof. Arbiter for this job. He and Herbert Kellogg teamed up in our July, 1951 issue to produce the best review of hydrometallurgy that *E&MJ*, or any other mining magazine for that matter, has ever published. Furthermore, Arbiter has had a lot of practical experience in ion exchange while working for one of the leading copper companies.

We have been very pleasantly surprised by the response to Adrian Dorenfeld's article on the application of Factorial Design to mill testing, which appeared in the October issue. For some time now, we have been stacking our chips (after taxes) on the bet that Statistics will one day be one of the mill man's most useful tools. The day may be closer than we thought. The October piece offered a Statistics bibliography to interested readers and the rate at which responses to this offer have come in indicates that more and more alert engineers are approaching their mill problems (and exploration, too) on a statistical basis.

Before we wallow too deep in self-satisfaction over this deal, we had better confess that we done Prof. Dorenfeld wrong in the lengthy "Editor's Note" that prefaced his article. We stated, "Early work on the application of Factorial Design to mineral engineering was done at Columbia University . . ."

We should have said "early work in statistics." Application of Factorial Design is original.

There's no provision in the *E&MJ* budget for hiring a detective in Tehran. If there were, we'd sure put an Iranian private eye to work finding out what's cooking at 26 Sevom Esfand St. (Three blocks past the depot, turn left, then right at the third barber shop. You can't miss it.) Almost every month we get a New Products Digest reply card from that address, with lots of numbers circled. This is fine. The only trouble is that one month the card is from "James, President, James & Co.;" Next month it's signed "George, President, George & Co." and so on from Abraham to Zenus. We are thinking that either this outfit has a very unstable management indeed, or 26 Sevom Esfand St. houses a flock of fugitives from an Orson Welles movie. If you happen to be passing through Tehran, we'd appreciate an informative word on this situation.

The Southern contingency among our readers, especially those frequently insisting that "the South shall rise again," should be happy to learn that Confederate currency is worth more than the Union's. According to the *Wall Street Journal*, Southern Comfort Corp. is promoting sales by offering to value a Confederate dollar bill as worth $1.50. If a patron orders a "Rebel-on-the-rocks" or a "Confederate highball" (both use Southern Comfort), the bar owner can send the note to the company which refunds him $1.50, postbellum U. S. currency. To date no $1 bills have been received; only $5's and $10's and the company is becoming a little apprehensive over the possibility of some $1,000 notes turning up.

We weren't going to mention it, but after last month's article, "How To Own Gold Without Breaking the Law," we feel we are only getting into the spirit of things by telling you how you can get a haircut for nothing. The gentleman who told us about the following incident could see no reason why it shouldn't work anywhere.

A man and a little boy walked into a tonsorial parlor together and sat down to wait their turn. When a chair was vacant, the man got into it and requested "a little off the top and a trim." When the barber was through, the customer told him to cut the boy's hair, "I have some shopping down the street."

After cutting the boy's hair, the barber told the young man he could wait in one of the chairs for his father. "That wasn't my father," said the boy. "He just came up to me on the street and said if I wanted a haircut for nothing to come into the barbershop with him."

We don't advocate this nefarious practice and only hope that if our own barber reads this, he is not a vindictive man.

Are you a conversational misfit? Do you envy your friends their ability to throw out a timely remark, to keep the conversational ball rolling? If so, the following piece of information is for you. Just toss it into the next conversational lull and stand back.

"Did you know—That Lincoln's Gettysburg Address contains 266 words—The Ten Commandments contain 297 words—The Declaration of Independence contains 300 words—And ESA's order to reduce the price of cabbage contains 26,911 words."

This observation came to us from the house organ of the Armstrong Machine Works via a route too devious to go into here. It's at least a unique commentary on government verbosity.

ENGINEERING AND MINING JOURNAL

NOVEMBER, 1952

Let's Consider the Trend

MORE AND MORE frequently we seem to be running into trend lines, those broadly-curved, sweeping strokes across a graph with which statisticians iron out the valleys and peaks in your business to tell you where you'll be 25 years from now.

The Paley Report, for example, sees an average trend in demand for minerals that rises to a point 90% higher by 1975 than it was in 1950. We'll have more to say about that in a moment.

We have no quarrel with trend lines, properly handled. It's just that we have been thinking how small a comfort it must be to a lead-zinc miner these days to reflect, as he looks up from the pit he now occupies, that the trend line of demand for zinc and lead is arching along over his head like a rainbow over a canyon.

On the other hand, if you're a copper miner, you are now seated uneasily upon a peak of demand looking down at the trend line as you would look at timberline in Colorado from 14,000 ft. You still have your "compensatory readjustment" to make, but with the state of the world what it is today, maybe you'll never have to make it.

In fact, we'd like to venture the opinion that not even the period of readjustment for lead and zinc will be as long or as grim as it looks right now. Let's examine the outlook.

That uneasy feeling you have about 1953 is probably caused by one or all of these factors:

1. The probability of a curtailment in defense buying.

2. Increased consumer resistance to high prices of autos, houses, appliances, and other things that use metals in large quantities.

3. Increased economic difficulties in foreign raw-material producing countries, which they'll expect the U. S. to handle, either by buying their materials or granting more loans.

Knowing that our administration, whether by now it has become Republican or is still Democratic, must still turn to pretty much the same sort of solutions to the problems we've outlined, we think those attempts at solutions will take these courses:

1. Defense spending simply isn't likely to end for a long, long time. If and when it does, Uncle Sam will be spending tremendous sums on atomic energy and other public works.

2. Consumer resistance to high prices will be weakened by a small slash in prices and a bigger slash in taxes, even if it means a Washingtonian orgy of deficit financing.

3. The troubles of raw-material producing nations may well be averted by a rising demand for some or all metals, lead for example. Lacking this natural aid, world-wide depression of metal markets can, and probably will, be avoided by U. S. stockpiling. Remember it was the U. S. stockpile program that touched off the recent overwhelming world-wide demand for metals. It has occurred to many people that *controlled* U. S. stockpiling could nicely balance a good many of the world's budgets.

So we will go on. There seems no bottom to the barrel; no limit on the expense account. If we are to consider seriously the building up of a 2-million-ton copper stockpile, or of one of 4.0 million tons of aluminum, obviously the old laws of supply and demand must be "readjusted," too, and the Paley Report's projections for 1975 may turn out to have been conservative.

One word of caution, however. We've found that the charts and the graphs showing projected demands for 1975, released by the Paley Commission and which we published in our September issue, are almost completely at variance with the PMPC's own figures in Volume 2 of their report.

We deeply regret having unwittingly helped propagate PMPC's errors in these graphs, and we suggest that all the report's estimates be scrutinized carefully before great reliance is placed on them.

It is all very well to pile up "projected demands," and to draw bold trend lines, when you know that your job and your reputation are not too deeply involved. However, when your position, perhaps your own and your company's income, are riding on your decisions, you are a little more conscious of the valleys ahead, as well as the peaks.

All we are sure of is that there *are* valleys ahead, but that there are peaks, too, perhaps higher, as we have said before, than any the mining industry has yet known. We'd feel a lot better if, in its thinking about them, the industry approached these new peaks, not along the skyrocket trail of the trend line, but on that cold rocky up-and-down path that is rough on one's feet at times, but is at least solid under them.

NOW RUNNING, Reserve's taconite beneficiation plant at Babbitt, Minn., includes, from right: mess hall and office; primary crusher; secondary crushing and grinding; magnetic separation, and, at left, the pelletizing furnaces.

Reserve Mining Co. Starts

First section, to produce 300,000 tons of concentrates annually, will help guide larger operation near Beaver Bay, where construction is progressing.

WATER for plant comes via 2-mi. 22-in. pipe line from Birch Lake.

RESERVE MINING CO.'S huge holdings of magnetic taconite at Babbitt, Minn., which it leases from Mesabi Iron Co. are at last beginning to yield their iron. Owned jointly by Republic Steel Corporation and Armco Steel Corporation, the Reserve company now has in an early stage of operation its preliminary commercial-scale plant at Babbitt which replaces the plant erected there in 1920-1922 by D. C. Jackling and his associates—30 years too soon, as it turned out.

This plant at Babbitt, which has an annual capacity of 300,000 tons of finished product, is complete from the first crushing stage through the final pelletizing. It is regarded as the first section of the ultimate 10-million ton plant also being erected by Reserve near Beaver Bay on the north shore of Lake Superior, and is intended to help organize for the larger operation.

Construction of the breakwater for the harbor and the townsite for the plant near Beaver Bay is now in progress, as the accompanying pictures show. A temporary power plant, and water and sewage systems have also been provided. This part of the enterprise along the lake has been given the name of "Lakeside Project."

The ultimate 10-million-ton plant (planned but not yet announced) will have 32 sections such as that at Babbitt. The first unit of eight sections, it is expected, will be

PLANT'S CAPACITY is about 2,500 tons taconite daily. Tailings thickener reclaims about two-thirds of plant's water requirement. Note top of one of plant's four pelletizing furnaces projecting through roof at upper left.

Taconite Plant At Babbitt

ready late in 1955. Four additional sections, composing a half-unit, are to be completed in 1957, bringing the capacity then available to 3,750,000 tons of finished high-grade taconite concentrates per year.

The total investment to the company at this point will be $160-million. The additional amount required to complete the ultimate 10-million-ton plant has not been made known.

An agglomerated concentrate of much more uniform consistency than natural ore and richer in iron units than any ore that has ever come out of the Lake Superior region, will be the final product of the beneficiation process. The crude taconite running under 25% iron (recoverable), in the form of magnetite, will be converted by beneficiation into iron ore pellets containing over 60% iron. It is known that, in cost per iron units, the pellets will be competitive with other Lake Superior ores.

Huge Tonnage—Long Life

The taconite orebody at Babbitt is about 9 mi. long, 2800 ft. wide, 175 ft. deep at the thickest point of the wedge-shaped cross section. It is virtually free of glacial overburden, and outcrops of the taconite are frequent. It is known to contain at least 1½-billion tons of magnetic taconite which can be mined by the open-pit method. At a 3 to 1 ratio of concentration, this will yield half a billion tons of high-grade concentrates, enough to supply 10-million tons annually for the next 50 years. In addition to proven deposits, geological studies indicate the presence of substantial additional tonnages of taconite on the property, about equal to the tonnages mentioned.

The open-pit mine is already supplying crude taconite to the preliminary plant at Babbitt. About 600,000 tons per year will be needed for this section. When the first 2½-million-ton unit of the Lakeside Project is ready for

Who's Who in Building Reserve Mining Co.'s $160 Million Taconite Beneficiation Project

THE OWNERS—Armco Steel Corporation and Republic Steel Corporation divide the ownership of Reserve Mining Co. equally between them.

OWNERS' AGENTS—Oglebay, Norton & Co.

THE CONTRACTORS:

For Lakeside Project—Hunkin-Arundel-Dixon, composed of Hunkin-Conkey Construction Co., Cleveland, Ohio; Arundel Corporation, Baltimore, Md.; and L. E. Dixon Co., San Gabriel, Calif.

For Babbitt Plant—McGraw Construction Co., Middletown, Ohio.

For Housing and Townsite

At Babbitt and Lakeside—J. D. Harrold Co., Duluth, Minnesota.

Babbitt Mine ready for production. Jet rig

ore, it will be necessary to mine 7½-million tons annually at the mine and more, proportionately, as the remaining units are completed.

The Procedure at Babbitt

After stripping the orebody, 40-ft. deep blast holes are prepared by jet-piercing. Benches about 35 ft. high are then blasted. The main orebody, depending upon its depth, will be mined with a series of such benches lengthwise along the orebody. Bench width will be sufficient to accommodate power shovels and ore cars.

Two 6-cu. yd. electric shovels with 5-yd. dippers are on hand at Babbitt. More shovels will be needed.

Coarse crushing will be done at the mine for both the Babbitt section and the big plant of the Lakeside Project. The primary crusher will be the world's largest, with a 60-in. receiving opening, and a 109-in. maximum diameter crushing cone. It weighs 1¼ million lb. It will crush 3,500 tons per hour and handle pieces 5 ft. on one dimension. Two 500-hp. motors drive it. It will take two years to build.

The crude ore is reduced in a two-stage crushing plant at Babbitt from chunks as large as 1 cu. yd. down to less than 4-in. pieces. This product will be shipped to the Lakeside plant, when it is built, and there crushed in two stages to about ¾-in. size. It will then be further reduced in 10 x 12-ft. rod mills. This is followed by magnetic separation, with the rejection of a tail which is mostly silica. The magnetic concentrate is then ground in ball mills and is then subjected to a second stage of magnetic separation with further discard of tailings.

The remaining magnetic material is then washed in a hydroseparator to remove the silica which is slightly magnetic (because it still contains a small amount of magnetite) but has too much silica to warrant processing further.

To produce 3,750,000 tons of pellets per year (1957) will require about 168 magnetic separators and 36 rod and ball mills at the Lakeside plant.

Fifty tons of water and 100 kwh

drills in ore.

of electric power are required in the plant per ton of the finished iron concentrate.

A Recap of Construction

The Plants. Babbitt plant is complete and in an early stage of operation. The Lakeside plant is under construction with temporary power plant, water and sewage systems. One breakwater for the harbor is being built, likewise the railroad.

Railroad. Twenty miles of the right-of-way have been opened from Lakeside Project to junction with D., M., & I. R. Railroad and should be completed this fall so that equipment can be hauled in. The remaining 27 mi. to Babbitt will be completed when Lakeside plant nears completion and is ready to receive ore.

Pipe Line. Water supply for Babbitt plant is provided by 2-mi. 20-in. steel line from Birch Lake. Capacity is 4,000 gpm. Two-thirds of water needed is reclaimed.

Harbor Development. The Pancake Island breakwater, to be 1800 ft. long and taking 760,000 cu. yd. of rock, was 75% completed on Oct. 7 and should be finished this month.

Townsites at Babbitt and on North Shore. These are to house 9,500 people by 1957. They have been designed by Pace Associates, Chicago, in consultation with University of Minnesota School of Architecture, and constructed by J. D. Harrold Co., Duluth. They will have every community facility to provide for commercial, educational, religious and recreational needs.

Both townsites are in the center of a sparsely populated region which contained less than one person per square mile prior to Reserve's construction program. All engineering and design are related to area's geology, topography, available construction workers, materials anticipated, future population and climate.

Homes in both locations are similar, but town layouts are completely different.

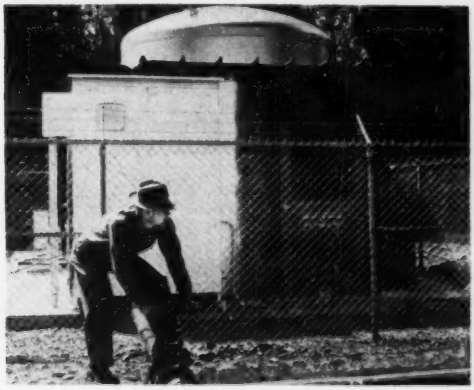
Considerable variety in houses is assured from five basic designs, all of which can be varied in room arrangement. All have full basements and are well insulated. The two-bedroom houses are one-story, those with three bedrooms two-story.

All houses feature picture windows, horizontal and vertical siding for trim, are well insulated, and have asphalt shingles or sheet metal roofing. An unusual feature is that the living area of each house is designed to face a landscaped area at the rear to make for more effective use of lawn and recreation areas.

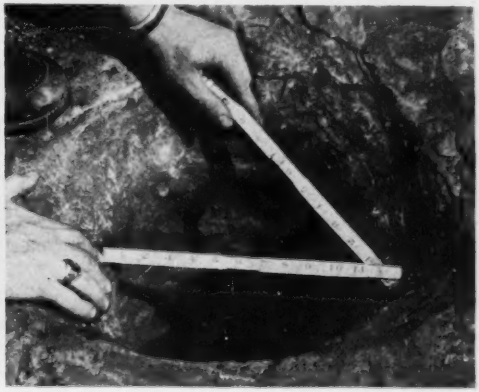
Minimum FHA requirements are far exceeded in these projects.

Babbitt. This town will house workers for the taconite mining operation, primary crushing, and the Babbitt plant. Eventually it will have about 1,280 families, 5,500 people, requiring 650 acres of land. About 380 dwellings will probably be needed when the 1½-unit Lakeside plant starts up. The street pattern has been designed to keep fast and heavy traffic off residential streets. Lots 75 x 125 ft. in size are provided, as is separate garden space.

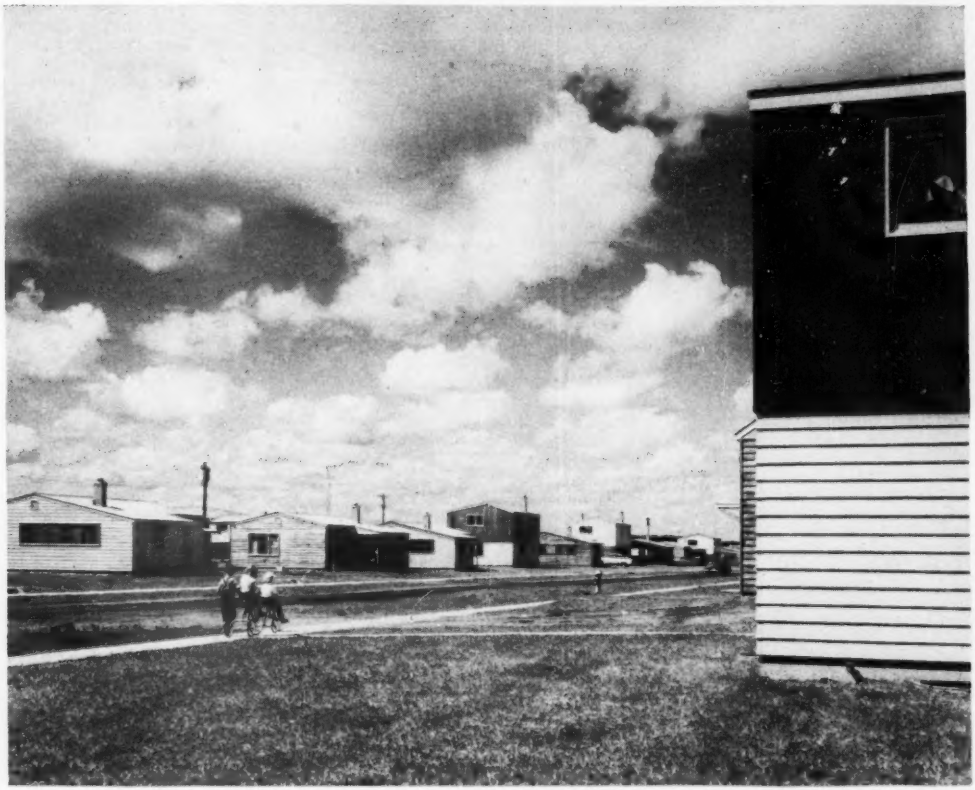
A year ago, construction began on 80 houses at Babbitt. Forty-



OXYGEN STATION at Babbitt supplying liquid oxygen to jet-piercing machines. Man opens valve in line to pit.



BLAST HOLE in taconite made by jet-piercing machine. Re-piercing enlarges original 7½-in. hole to 11 in.



NEW TOWN of Babbitt, which will eventually house 1,280 families (5,500 people). Lots are 75 x 125 ft., separate garden space is provided. Shopping center, other facilities are provided for employees at mine and plant.

Good homes are part of mining, too.

LIVING ROOMS in Babbitt's houses are 30 ft. long, have three picture windows. That's the water tower in distance.

STREAMLINED KITCHENS are wholly modern, make housework easier. This is typical of those in townsite.

How Reserve Mining Co. Came To Acquire Taconite Holdings of Mesabi Iron Co.

1871 Low-grade iron-bearing rock, now called taconite, disclosed by Peter Mitchell in test pit on the Mesabi on what is now Reserve Mining Co. property at Babbitt, Minn. The first reported discovery of iron on the range.

1875 Original Mesaba Iron Co. organized. It acquired a good part of taconite lands now under lease to Reserve Mining Co.

1905 Properties formerly under control of Mesaba Iron Co. purchased by three men who formed two companies, also acquiring additional mineral-bearing land.

1915 Mesabi Syndicate organized by group, with D. C. Jackling as driving force. Syndicate following year built 100-ton per day experimental plant in Duluth in which processes and apparatus for treating taconite were developed. A few years later the syndicate acquired leases on Babbitt properties, bought surface of adjacent land for plant, tailings disposal basin, townsite, etc.

1919 Mesabi Iron Co. was incorporated in Delaware Dec. 12. Took over assets, processes, etc., developed by Mesabi Syndicate in experimental plant in Duluth; started construction of beneficiation plant, town and facilities at Babbitt in 1920.

1922 Beneficiation plant of Mesabi Iron Co. completed and ready for operation in July.

1924 Operation of Mesabi Iron's plant discontinued in June unable to compete with Mesabi direct shipping ores. Company had mined 516,021 gross tons of taconite, concentrated it at 3.3 to 1 ratio, and shipped 156,370 tons of sinter running 61.91% iron, 0.032% phosphorus, 10.6% silica, and 0.91% moisture.

1929-
1937 Late Joseph H. Frantz, of American Rolling Mill Co. (now Armco), and the late R. C. Allen, of Oglebay-Norton & Co., decide to investigate potential ore reserves, which could be carried economically for years before going into production. Mr. Allen investigates methods and costs involved in beneficiating magnetic taconite, and in 1937 begins negotiations for leasing properties under lease to Mesabi Iron Co.

1939-
1941 Reserve Mining Co. is organized on March 24, 1939, as Minnesota corporation by Oglebay-Norton & Co. as agents for stock-holding interest comprising Armco, Wheeling Steel Corporation, Montreal Mining Co., and Cleveland-Cliffs Iron Co. On Oct. 17, 1939 Reserve obtains certain leases on properties held under lease or owned by Mesabi Iron Co., some for surface rights alone, and others with non-mineral rights. In 1940 and 1941 following, the property at Babbitt is put in standby condition and obsolete equipment and material are removed and sold.

1941 Taconite tax law is passed by Minnesota Legislature definitely limiting the amount of *ad valorem* tax that could be assessed against taconite land and mining facilities, and assessing a special production tax on taconite ore in its place.

1942 Experimental work is undertaken by Reserve personnel, in collaboration with Dr. E. W. Davis, director, and staff of Mines Experiment Station at Minneapolis, to determine an economic method of processing the magnetic taconite of the Babbitt area. In the 1941-1942 period, Dr. Davis and his staff had been working on a method of agglomerating the fine taconite concentrates by pelletizing. Cooperative experimental work continued thereafter.

1947 Decision having been made to erect a large beneficiation plant near Beaver Bay, on the north shore of Lake Superior, Reserve obtains permission from U. S. Government to build a harbor near Beaver Bay. Permits are also obtained for using Lake Superior water for processing at this plant and for depositing the tailings produced in Lake Superior.

1948 Tests begun with pellets as burden in small experimental blast furnace at Minnesota Mines Experiment Station. Iron produced is said to be first made from taconite alone. To develop agglomeration by pelletizing on a semi-commercial scale, the partners in Reserve at that time erect a pilot plant at Armco's division at Ashland, Kentucky. This is put into operation early in 1949.

1949 Route is surveyed for railroad from taconite open pit at Babbitt to Lakeside Project, as the taconite beneficiation project near Beaver Bay is known at present.

1950 July First test with pellets in blast furnace burden in commercial size blast furnace is made at Armco's Sixth Street furnace at Ashland, Ky. A series of 10-day runs using various percentages of pellets in burden are made.

1950 Sept. Republic Steel Corporation acquires 42½% ownership in Reserve Mining Co. Contracts are let for construction at Lakeside Project, near Beaver Bay.

1951 Dec. Armco and Republic each acquire a 50% stock interest in Reserve Mining Co., by purchase of 15% interest in Reserve owned by National Steel Corporation and dividing it equally between them.

five more are now virtually completed. All have individual garages and sidewalks. Many facilities are provided.

Lakeside Project. This city, which is expected to acquire a new name some day soon, will house the personnel who will operate the Lakeside processing plant together with their families. Ultimately it will house more than 1,500 families. It is expected to become the largest city on the North Shore of Lake Superior, except Duluth. The street pattern will differ from that at Babbitt. In general the houses will be in a natural amphitheatre affording a fine view of the lake and harbor.

Houses and row-houses under construction will furnish shelter for 46 families. Temporary buildings are in use for schools.

How Many Jobs Will Be Created?

Official records show that 1,000 men in the iron mining industry means 2,000 in supplementary employments, such as doctors, teachers, grocers. These 3,000 will support more than 4,000 dependents. All will maintain 100 retail stores and create more than $7-million in annual retail trade.

Babbitt has about 200 men working in the plant and mine. At the Lakeside Project the Reserve company now has about 70 men, mostly engineers, specialists and staff. By 1957, about 1,300 jobs will have been created at both plants.

Taconite processing takes about three times as many men per ton of concentrate produced as open-pit mining or as the mining of direct-shipping ores. Besides it is a year-round operation.

Construction personnel will be 1,500 maximum at peak. Today it is about 800.

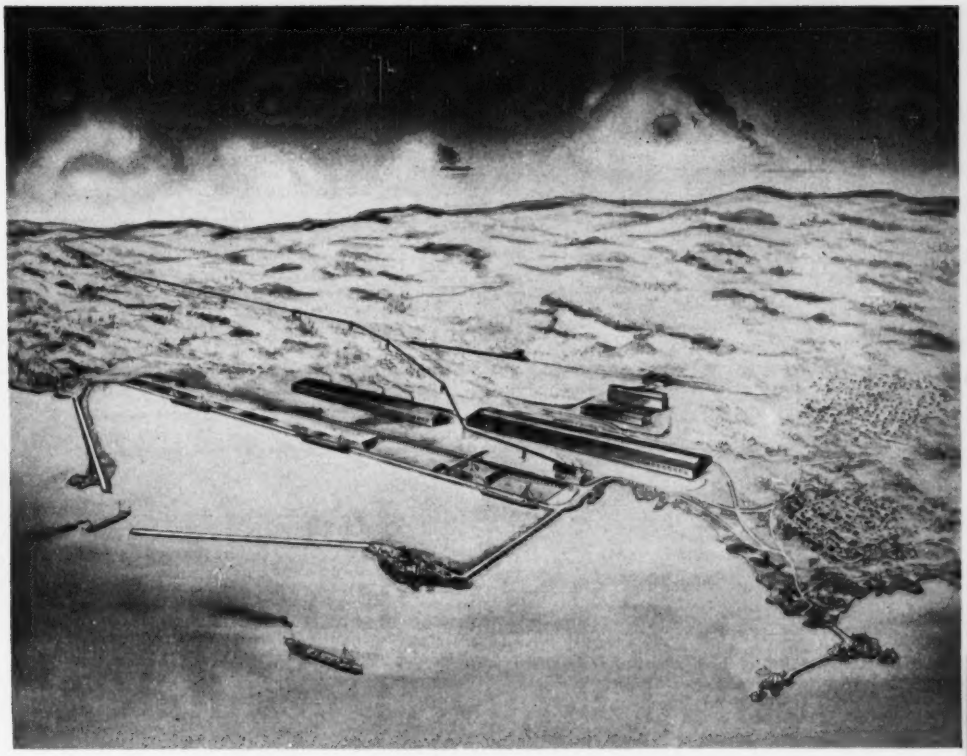
(Continued on Page 78)

LAKESIDE PROJECT, NOW, where harbor is being built to shelter ore boats. Breakwater reaches out 1,800 ft. to Pancake Island; another will go to Gull Island, background. First breakwater will have 760,000 cu. yd. of rock.

Building the second-largest city on Lake

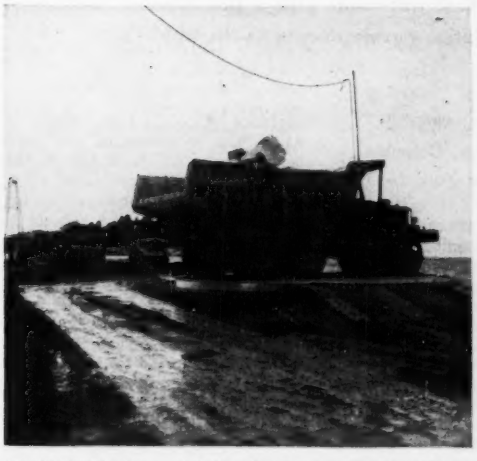
DITCHING the railroad right of way between Babbitt and Lakeside Project. Line will be 47 mi. long when complete.

DRILLING blast holes in large boulders along lake shore for use in building breakwater shown in photo above.

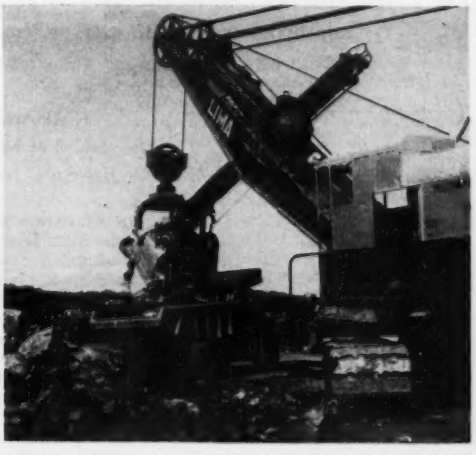


LAKESIDE PROJECT TOMORROW, shows how railroad from Babbitt, final large beneficiation plant, harbor and loading docks will look when completed. Trains with diesel-electric locomotives will have 80 to 90 100-ton cars.

Superior's North Shore is part of Reserve's job.



HAULING broken rock to breakwater requires Lazy-Susan turntable near end so trucks can dump to rear and return.



EXCAVATING for Lakeside Project plantsite, shown above, with 6-yd. shovel. Town will house 1,500 families.

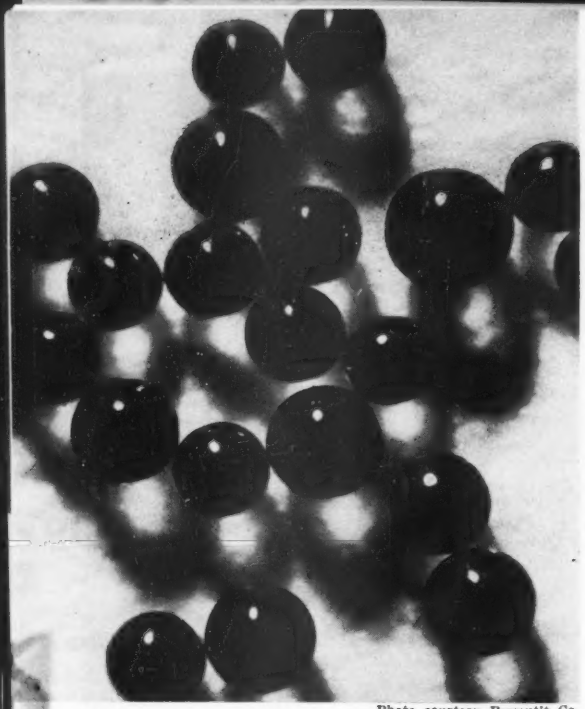


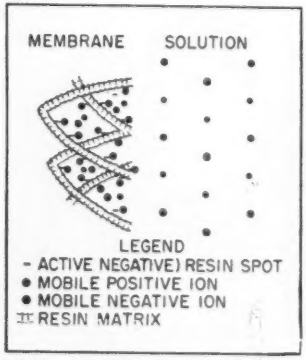
Photo courtesy Permutit Co.

PHOTOMICROGRAPH of high-capacity, cross-linked polystyrene cation exchanger.

Ion Exchange ...Does it Have

For some time now mining men have been asking about ion exchange. What is it? How does it work? What does it mean to the mining industry?

We discussed the problem with Prof. Arbiter, and he has come up with this article that answers all these questions plus a few more, and brings you up to date on the latest developments in the application of ion exchange.



ION TRANSFER MEMBRANE exchanges ions with solution.

NATHANIEL ARBITER
School of Mines, Columbia University, New York, N. Y.

ION EXCHANGE IS LITERALLY as old as the hills, first studied in 1850 by the English chemist Way in the reaction of inorganic fertilizers with soils. It has been going on since the first rain fell, leached surface minerals, and carried away dissolved salts to react with other minerals in depth. Most generally, it is a reaction between a solid and an aqueous solution in which ions from solutions displace similarly charged ions from the solid. It is convenient, however, to distinguish exchange reactions confined to the surfaces of solids from others in which the structure of the solid permits penetration of ions to the interior. In the first case, illustrated by the sphalerite-copper ion example in Table 1, the process is usually called "exchange adsorption." The extent of reaction, with a given amount of solid, depends on its specific surface. Commercial exchangers (Table 1), whose entire mass is available for reaction, will have capacities of the order of 2,000 times those of granular impermeable solids.

How It Works

Practical application of the ion exchange process involves down-

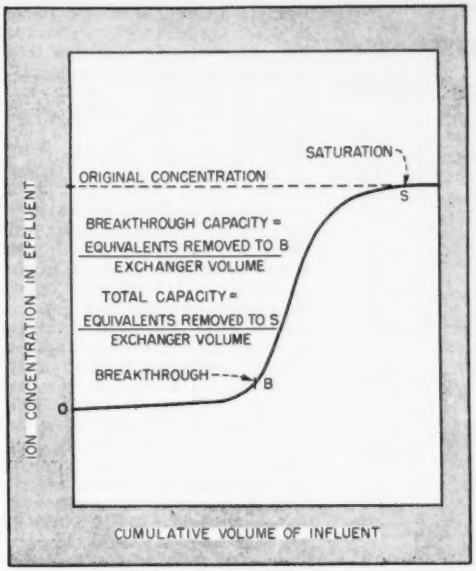


FIG. 1. CONCENTRATION HISTORY of passage of a solution with a single ion through an exchanger bed.

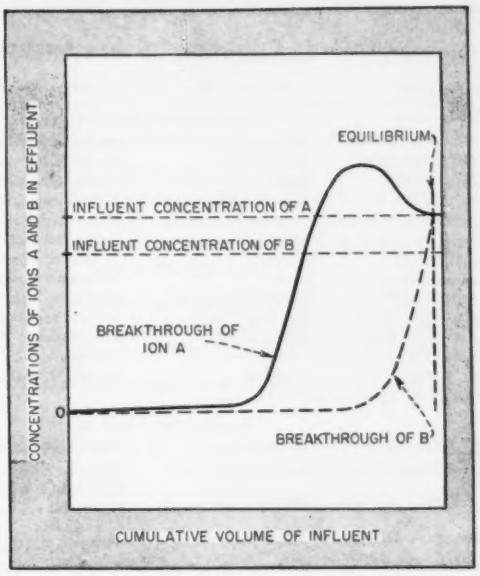


FIG. 2. HISTORY OF A SOLUTION containing two different ions. Until break-through, exchanger removes both.

a Role in the Mineral Industry?

ward percolation of the solutions to be treated through beds of exchanger granules, half filling closed cylindrical tanks. Materials are available to remove either cations or anions from solution. Cation exchangers will replace all positive ions on an exactly equivalent basis by either Na or H as desired; anion exchangers replace anions usually by OH^- or Cl^-. An exchanger bed has a fixed exchange capacity, determined by its composition and by the method of regeneration. The capacity is the number of equivalents of ions it can remove from solution while yielding a discharge or effluent water of suitable quality. Fig. 1 illustrates a "concentration history" during the passage of a solution containing a single ion through an exchanger bed. Up to point B on the curve the effluent solution is substantially free of the ion being removed. Point B is designated as "break-through," and the capacity of the bed up to B is the break-through capacity. The break-through capacity depends on the exchanger itself, and on the flow rate, solution concentrations, and effectiveness of previous regeneration. The bed will remove a further quantity of ions after break-through, but the effluent contains progressively more of the same ion. Finally at S, the bed is saturated and the effluent and influent solutions are at the same concentration. The capacity of the bed at S is "saturation or total capacity."

When the bed is exhausted, the flow is shifted to a stand-by unit and the bed is regenerated. This involves treatment with fairly strong solutions of acid or brine for cation exchangers, or of sodium hydroxide or carbonate for anion exchangers. Regeneration displaces adsorbed ions for discard or recovery while simultaneously restoring bed capacity. It is thus a reversal of the absorption cycle, taking advantage of mass action principles.

If a solution containing two different ions, say calcium and copper, is passed through a bed of cation exchanger, the concentration history will be given by a curve such as Fig. 2. Until break-through, the bed removes both cations completely. Subsequently, depending on the identity of the ions and on the exchanger, one or the other of the adsorbed ions will be displaced from the bed and appear in greater concentration in the effluent than in the influent. At saturation, the proportions of the two ions in the bed will differ from their proportions in solution.

Chronology of Ion Exchange

1850—Way described ion exchange properties of soils.

1910—Use of natural siliceous exchangers for water softening proposed by Gans.

1935—Ion exchange resins synthesized by Adams and Holmes.

Why It Works

The properties of exchanger beds are determined by the structure of the solid and by the character of its active groups. The exchange process as a whole depends both on the exchanger and on the concentration and identities of the ions in the solution being treated by the exchanger.

Table 1—Commercial Ion Exchangers

Name	Manufacturer	Active Group	Capacity*
	CATION EXCHANGE		
Amberlite IR-100	Rohm & Haas	Methyl lead-sulfonate	1.75
Amberlite IR-105	Rohm & Haas	Methyl lead-sulfonate	2.70
Dowex—30	Dow	Methyl lead-sulfonate	4.00
Nalcite MX	National Aluminate	Methyl lead-sulfonate	4.00
ZeoRex	Permutit	Methyl lead-sulfonate	2.70
ZeoKarb	Permutit	Sulfonated coal	1.62
Permutit Q	Permutit	Sulfonated styrene	4.2
Dowex 50	Dow	Sulfonated styrene	4.25
Nalcite HCR	National Aluminate	Sulfonated styrene	4.25
Amberjite IR-120	Rohm & Haas	Sulfonated styrene	4.20
Amberjite IRC-50	Rohm & Haas	Carboxylic	10.0
Permut it-H	Permutit	Carboxylic	5.3
Permutit	Permutit	Aluminum silicate	1.0-3.0
Sphalerite 48 +325 mesh			3.8 x 10-3
	ANION EXCHANGE		
Amberlite IR-4B	Rohm & Haas	Weak base amine	10.0
Amberlite IR-45	Rohm & Haas	Weak base amine	6.0
Amberlite IRA 400	Rohm & Haas	Quatenary amine Strong base	2.3
Amberlite IRA 410	Rohm & Haas	Strong base Quatenary amine	2.5
Dowex 1	Dow	Quatenary amine	2.4
Dowex 2	Dow	Quatenary amine	2.3
Deacidite	Permutit	Quatenary amine	9.3
Permutit S	Permutit	Quatenary amine	5.5

*Milliequivalents per gram

Physical Structure of Exchangers

Until the development of the synthetic resin exchangers after 1935, the solids used for ion exchange applications were either natural or synthetic alumino silicates, loosely called "zeolites." More recently, sulfonated coals and then the completely synthetic exchangers have made available higher capacity and extremely durable materials as well as practical anion exchangers.

Crystal structure studies of the naturally occurring silicates with practical exchange capacity indicate an open three-dimensional network of silicate chains with the spacing between crystal units adequate for the diffusion of water molecules and solute ions. The synthetic resin exchangers, while differing completely in chemical compositions, have the same open physical structure. The resins are obtained by polymerization reactions of the phenol-formaldehyde benzene type, with the active group incorporated either before or after polymerization. The resin structure involves long hydrocarbon chains cross-linked to a controllable degree between chains.. The variable cross-linking permits some control of the porosity of the resins, and thus of the maximum diameter of ion which can penetrate the resin structure. The accessiblity of the active groups within the resin structure to diffusing ions is so complete that capacities calculated from assays agree very closely with those experimentally determined.

Active Groups

While the physical structure of exchangers thus controls the accessibility of active groups within the solids to the solution and the size of ions which can penetrate, the chemical properties depend entirely on the ionizable group. (The identity of this group determines whether the exchanger will be acidic or basic and hence useful for cationic or anionic exchange: it determines the pH range in which the exchanger will be effective, determines the possibility of selective adsorption effects toward mixtures of ions, and finally, according to the number of active groups per unit volume of exchanger, fixes the exchange capacity.)

Table I lists the active groups used in commercially available exchangers. The most important characteristic of the active group is its basic or acidic strength. In the case of cation exchangers, the acid strength determined the pH range in which the exchanger is effective for cation removal and the acid strength necessary for regeneration. The sulfonic acid exchangers, which are the only strongly acidic materials, are obtained either by sulfonation of coal (Zeokarb) or by complete resin synthetic (Dowex 50, Permutit Q, Wofatit K). These are effective at pH's as low as 12—; but require of the order of 5% sulphuric acid or stronger for effective regeneration. The weaker acid exchangers, which are based on either the silicates or the carboxyl group, are ineffective for cation exchange at a pH lower than 6.7. Phenolic groups, present in minor amount in sulfonated coals, can only be utilized in alkaline solutions. This restriction is still valid when the exchangers are used in the salt rather than the hydrogen form. In acid solutions, H will displace all other cations from the weakly acid exchangers.

A similar limitation exists for anion exchangers. The weakly basic amine exchangers are effective only for removing anions of relatively strong acid from solution and will not remove anions such as silice, and carbonate due to hydrolytic effects. The recent development of strong base quaternary amine resins, however, now permits removal of both strong and weak acid anions.

While the ion exchange theory is undergoing rapid development, the basis for a simple quantitative treatment is not yet available. Qualitative interpretation is possible by application of familiar mass action principles. Thus for cation exchange the reaction;

$$(\text{Resin H})^{+} + (\text{Metal})_{\cdot}^{+} \leftrightarrows (\text{Resin Metal})^{+} + (\text{H})_{\cdot}^{+}$$

and the equation:

$$\frac{(\text{Resin Metal})^{+}}{(\text{Resin H})^{+}} = K \times \frac{(\text{Metal})_{\cdot}^{+}}{(\text{H})_{\cdot}^{+}} \qquad (1)$$

express the effects of variation in solution concentrations on the ion concentrations in the exchanger. Exact application of the equilibrium principle requires the use of activities rather than concentrations.

For practical purposes the following empirical rules adequately summarize exchange principles:

1. At low solution concentrations, the exchange tendency increases with valence: e.g. $Na^{+} < Ca^{++} < Al^{+++}$

2. At low solution concentrations, exchange tendency increases with

atomic number: $Li^+ < Na^+ < K^+ < Rb^+ < Cs^+$; $Mg^{++} < Ca^{++} < St^{++} < Ba^{++}$

3. For anions the following order of exchange is found: sulphate > chromate > citrate > tartrate > nitrate > arsenate > phosphate > molybdate > acetate = iodide = bromide > chloride > fluoride.

4. The position of H^+ or OH^- in the exchange series depends on the functional group of the exchanger. With strongly acidic or basic groups, H^+ or OH^- can be displaced by all cations or anions; with the weakly acidic or basic exchangers, H^+ or OH^- is more strongly held than other cations or anions.

5. At high solution concentrations or high temperatures, these rules may no longer hold.

The mass action equation (1) and the ionic series given above govern qualitatively the response of an exchanger to mixtures of anions. The effects of ionic charge and atomic number or ionic weight may often outweigh unfavorable mass action effects. For example, low concentrations of polyvalent, high weight ions can often be removed from strong solutions of simpler ionic species.

Applications

The applications of ion exchange depend upon the ability of exchangers to remove ion quantitatively from solution up to break-through capacity, provided that the solution does not already contain an unsuitable concentration of the ion being displaced from the exchanger. The removal up to break-through, although quantitative, is non-selective; all cations are removed by a cation exchanger, and all anions by an anion exchanger. While selectivity is not obtainable in adsorption among ions of the same charge sign, it can often be obtained in desorption (elution) particularly by the use of the so-called chromatographic techniques: These, however, require carefully controlled conditions, usually more expensive regenerants, and sacrifice in bed capacity.

Where ions differ in sign of charge, or where ions are to be separated from neutral molecules, separations are simple and complete. Thus a cation exchanger can separate all cations in a solution from the anions, and an anion exchanger can do the opposite. Solutions of neutral molecules can be completely deionized by use of both types of exchangers, either alternately or in mixed beds.

Finally, as previously indicated, polyvalent ions of large ionic weight may have sufficiently strong adsorption tendency to counteract unfavorable concentration ratios. Thus, in a sense, they can be selectively adsorbed. Some of the present applications of ion exchange which illustrate these effects are listed in Table 2.

Table 2—Commercial Applications of Ion Exchange

WATER SOFTENING	Removal of Ca^{++} and Mg^{++} from municipal and industrial water supplies to lower levels than possible by chemical precipitation.
DEIONIZATION	Complete removal of ions to produce a low cost equivalent of distilled water for high-pressure steam boilers, pharmaceutical and chemical plants and other applications needing ion-free process water.
FOOD PRODUCT TREATMENT	In the processing of beet sugar, corn, pineapple, orange and grapefruit liquors to remove impurities and acid in by-product recovery.
PHARMACEUTICALS	Extraction of antibiotics from impure solutions.
METAL RECOVERY FROM WASTES	Recovery of copper sulphate from cupro wastes; purification and recovery of chromium in plating and metal treating; purification of phosphoric acid used in pickling baths.

Advantages of ion exchange do not depend entirely on the chemical aspects of the process but on the physical properties of the exchanger as well. The exchanger is an ideal precipitate. It is coarsely and invariably granular, no matter what ions it contains. It can be retained by a sand bed in fixed bed units, and in such applications it combines the functions of precipitating tank, thickener and filter in one piece of equipment.

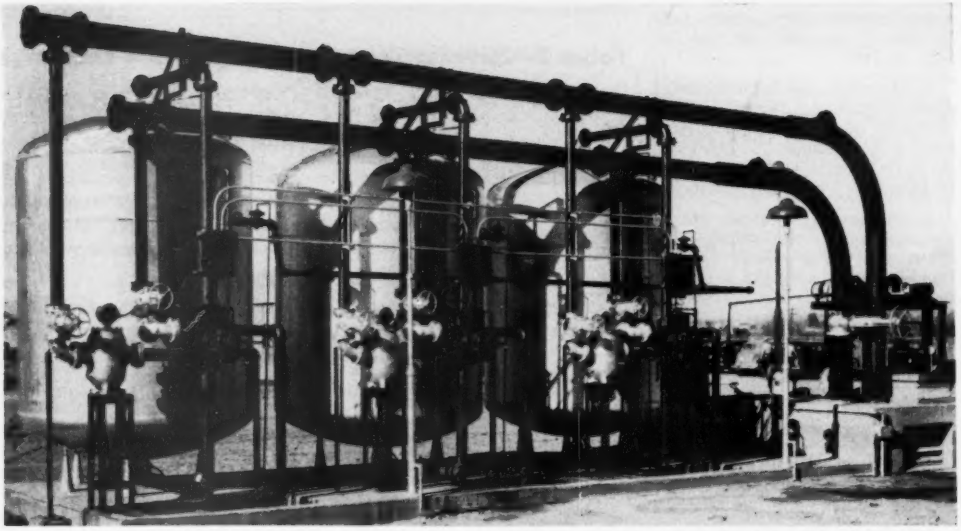
Synthetic exchangers will ideally retain original capacity indefinitely. Mechanical loss through breakdown of granules is of the order of a few percent per year in water softening service. Hence reagent cost is essentially that for regeneration which usually involves low cost materials such as salt, sulphuric acid or soda ash.

Hydrometallurgy

To forecast the potential role of ion exchange in tomorrow's metallurgy it is necessary to consider not only today's practice but future sources of metals as well. Leaching practice today involves the dissolution of metallic compounds from ores or concentrates with either direct electrowinning from the leach solution, or precipitation of metals or metallic compounds from it. In the latter case, the precipitates are converted to metal by smelting or by fused salt electrolysis. The major applications of leaching are to the recovery of aluminum, copper, gold, magnesium (sea water), uranium-vanadium, and zinc, with indications that it will soon be important for nickel and cobalt. (Nicaro, Sherrit-Gordon, Calaveras, Fredericktown) Table 3 summarizes important features of these applications.

With the exception of the gold and magnesium circuits, leach solutions are all concentrated. Separations of the major metal from impurities are usually not carried out on the leach solutions but are obtained by preconcentration, selective solvents, or selective electrowinning. Exceptions are the magnesium-calcium separation from sea water and copper-cadmium cementation from solutions of zinc electrolyte.

Three trends appear inevitable for the future. Grade of ore on the average will continue to decline for all metals. This will be due both to the exploitation of new low-grade deposits and to lower ore-waste cutoffs in present operations. There will be increased recovery of minor



BATTERY OF CATION EXCHANGER units could be used for concentration of dilute solutions or the purification of metal salt solutions. Units like these have been used to recover magnesium from sea water.

metals from ores and concentrates of other metals. Finally, there will be increased recovery of metals from mine waters, dump leaching and industrial waste solutions. These trends, it is believed, will increase the importance of leaching methods and solution handling for metal recovery.

The applicability of ion exchange to hydrometallurgy will depend on its two unique features:

1) The possibility of producing concentrated metal salt solutions from dilute solutions with quantitative recovery of values.

2) The possibility of purifying metal salt solutions by separating ions of opposite charge, ions from neutral molecules, or in special cases ions of the same charge.

Concentration of Dilute Solutions

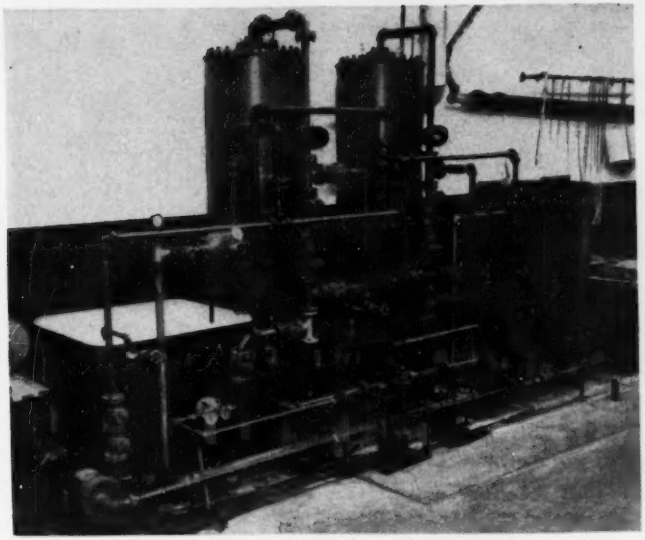
This application of ion exchange is well established. With exchanger beds operated to break-through, and with inexpensive regenerants, it is normally non-selective. The ratios of concentration obtained with a fixed regenerant strength will vary inversely as the normality of the dilute solutions. The utility of such concentration depends on the possibility of a direct use for the concentrated solution, or on a more efficient subsequent handling of a concentrated than of a dilute solution.

In present leaching operations there are several conceivable applications. Dilute wash solutions in electrowinning circuits can be concentrated independently of CCD or percolation solution advance. This, for example, could make washing of leach residues independent of water balances. It could also permit very low-grade solution to be concentrated to the range of electrowinning strengths. An example, although applied to activated charcoal, is the very recently reported electrolysis of gold-cyanide solutions obtained by regenerating loaded carbon with strong cyanide solutions.

Where metals or metallic compounds are precipitated from solution rather than electrolyzed, the value of concentrating dilute solutions is questionable unless other benefits are obtained. The only gain in such cases is the replacement of a thickening or settling operation on a dilute suspension by the same operation on a concentrated one. The added cost of ion exchange will probably compare unfavorably with the savings in thickening. On the other hand, where space is at a premium, where thickening of precipitates must be carried on indoors (as in cold climates), or where precipitates are difficult to thicken or filter, then the exchange process may be of definite value in reducing the volume of slurry to be thickened or perhaps heated to improve the dewatering operations.

A related application is illustrated by the present use of coarse activated carbon in cyaniding of slimey gold ores. Adsorption of values directly from the pulp by the carbon, followed by screening out the carbon, eliminates washing and dewatering of the leach tailings, as well as filtration of gold precipitates from the barren solution after zinc treatment. As already mentioned, further simplification results from electrowinning of gold after regenerating the loaded carbon. Exchange resins are now being studied for this application. Although published results (2) and more recent unpublished results indicate that the performances are not yet quite comparable with those for activated charcoal, there is no inherent reason why the resins should not be eventually useful.

The chemical versatility of the exchange technique should make applications of this type possible for ions other than the gold cyanide complex. These will have the important limitation that only very dilute solutions with respect to adsorbable ions can be treated. If this is not met, then the amount of resin to be processed per ton of ore would become prohibitive. This limitation in turn means that the process can be applied only to very low-grade ores of high unit value metals and that the valuable ions



THIS EXCHANGER UNIT has meant dollars and cents to Grumman Aircraft Co. in the recovery of chrome from solution

must be more selectively adsorbed than solvent ions. Some of the factors which may favor this condition have already been indicated.

Purification of Metal Salt Solutions

Although one of the most striking applications of ion exchange was in the fractionation of the rare earth elements, it is unlikely that separations of this type will be used in the primary recovery of common metals. In the first place, Table 2 shows that the purification of metal salt solutions is of minor importance in major leaching flowsheets in comparison to selective solvents or preconcentration. It is also true that most hydrometallurgy today involves fairly strong solutions for which ion exchange is of limited applicability. For example, it is unlikely that the process will ever compete with cementation for purification of zinc electrolyte.

A more feasible application to current practice would appear to be in the recovery of magnesium from sea water. This is now accomplished by precipitation of $Mg(OH)_2$ with lime, thickening, filtration, resolution of the precipitate in HCl, and precipitation of calcium as sulphate from the solution. The $MgCl_2$ product must be of sufficient purity to permit fused salt electrolysis. If the sea water could be passed through a resin bed with selective recovery of magnesium ion, followed by regeneration to yield a $MgCl_2$ solution of satisfactory purity, there would be an indicated savings in chemicals and in several dewatering steps. Although various types of resin application for this purpose have been patented, a completely acceptable process has apparently not yet been developed. This is probably due to the fact that Mg and Ca are sufficiently close in ionic properties to prevent a favorable separation factor, as well as to the relatively high concentration of Na ion in sea water. This latter would reduce the effective capacity of a resin for Mg^{++}. Successful application of ion exchange to magnesium recovery may require an exchanger highly specific for Mg^{++} ion.

Description of some of the present applications of ion exchange to metal recovery and purification problems will illustrate its positive advantages.

Copper from Rayon Manufacturing Wastes. The cuprammonium process produces large quantities of dilute rinse water containing copper-ammonia-complex ions, NH_4^+, Na^+ and $SO_4^=$. Both in Germany during the war and more recently in this country, the copper is recovered commercially on a cation exchanger. This is regenerated with sulphuric acid, and the strong solution re-used in the process. A similar application for zinc concentration from acid solutions has been developed. Such applications are ideal for the exchange technique in that the regenerant solutions can be used directly. Alternative processes would involve precipitation of values, dewatering and resolution.

Purification of Chromic Acid Solutions. The anodizing of aluminum requires strong chromic acid solutions which become fouled with dissolved aluminum and chromic ions. Practice has been to bleed off solutions to discard. Use of a cation exchanger permits treatment of a small portion of the electrolyte daily to remove metallic cations and return of the purified chromic acid to the circuit. Another application, also on chromate solutions, is the use of an anion exchanged to recover chromate ion from rinse waters.

Removal of Metals from Strong Acids. Metallic ions which are normally cations may form anionic complexes in strong acids. Examples for $FeCl_4^-$ and $AlF_6^{\equiv}$. These can be removed from the acids by strong base anion exchangers; moreover, metals which form such complexes can be separated from those which do not by such procedures. A practical application is the removal of traces of iron from hydrochloric acid solution.

A similar highly specific adsorption tendency permits the removal of complex ions such as vanadates from phosphoric acid solutions.

New Developments

The preceding discussion has been based on fairly well established exchange principles and practices. Two recent developments in exchange materials should be mentioned. An "electron exchanger" has been prepared based on a reversible oxidation-reduction reaction in the resin's active group. This can lead to use of the exchange technique for aqueous oxidations or reductions instead of using soluble oxidizing or reducing reagents.

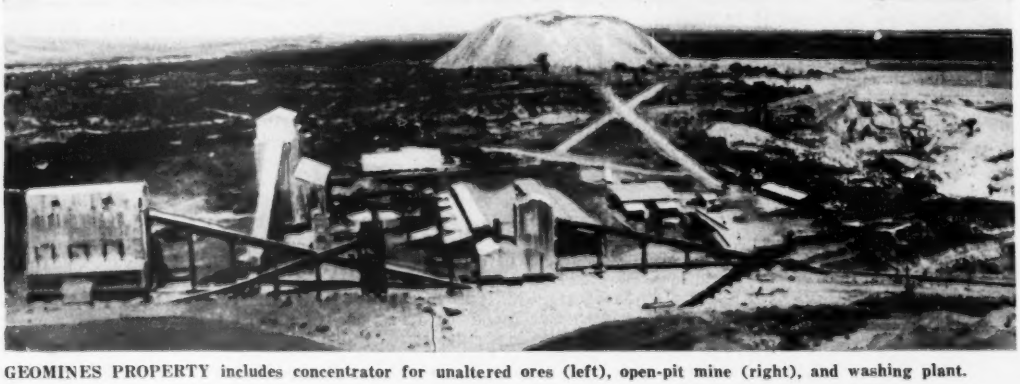
Resins have now been prepared in the form of durable membranes which are selectively permeable to either cations or anions. When suitably arranged in an electrolytic cell, these permit the deionization of water or aqueous solutions. This is an alternative to conventional deionization with granular exchanger beds; it substitutes electric power for the chemicals normally used to regenerate the exchanger. Several other applications are being investigated.

OPEN-PIT MINING EQUIPMENT in the unaltered pegmatite orebody consists of I-R Quarrymasters, Bucyrus churn drills, and 20-ton Easton side-dump semi trailers. Broken ore is handled by 170-B Bucyrus Erie shovels.

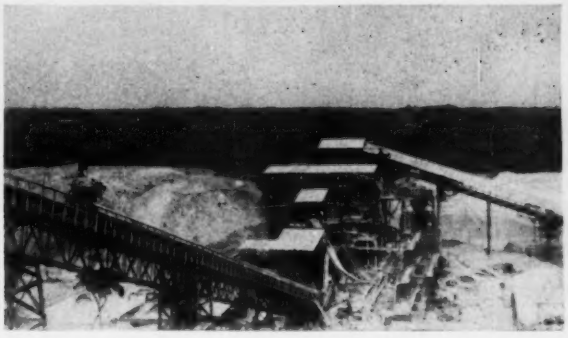
Geomines—A Major Open-Pit Tin Producer in the Belgian Congo

In response to world-wide interest in this important expanding source of tin concentrates, *E&MJ* is privileged to present a first-hand authoritative account of operations by H. Barzin, managing director of Geomines. Geomines is short for Compagnie Geologique et Miniere des Ingenieurs et Industriels Belges, with headquarters in Brussels, Belgium.

H. BARZIN, Managing Director of "Geomines"



GEOMINES PROPERTY includes concentrator for unaltered ores (left), open-pit mine (right), and washing plant.



IN THE ALTERED OREBODY, softer materials are mined by electric shovel, loaded onto conveyor, and transported to the above washing plant which removes mud from the ore and concentrates cassiterite with jigs and screens.

THE ORE DEPOSIT AT MANONO, in the Katanga, Belgian Congo consists of two pegmatitic laccoliths running parallel to each other in a general southeast-northeast direction and separated by a break or gap of 2½ km. In this gap, the Lukushi River flows.

Each pegmatite lens is about 5½ km. long, ranging in thickness from 50 to 800 m., and averaging about 400 m. Of this, an approximate depth of 125 m. has been explored with 6-in. drills. Core recovery has never been less than 90%. Although the limit of 125 m. has been established arbitrarily, the deposit actually extends to greater depth.

Contacts Are Irregular

Indications are that the position of the pegmatite came about through the "digestion" or absorption of the schists. As a result, the pegmatite-schist contacts are irregular. These schists belong to the lower Kibara. They are subvertical and strike roughly southeast-northwest.

The pegmatite is completely holocrystalline, and is made up of feldspar, spodumene, quartz, and leucocrate micas. It contains an unusually high proportion of tin in the form of cassiterite, namely 2 to 3 kg. per cu. m., as well as tantalocolumbites in the proportion of 5 to 7% with respect to the cassiterite. The cassiterite is distributed uniformly in the pegmatitic mass in relatively small grains. More than half are less than 0.5 mm. in size.

The pegmatite has been altered by atmospheric agents to varying depths, averaging about 10 m. In the western section of the deposit, this alteration extends to a depth of about 50 m. A typical section through the orebody reveals leached pegmatite, sand, and laterites on the surface, then altered pegmatite, and finally hard unaltered pegmatite at depth. A mixture of dolerite affects both the schists and pegmatite in the eastern section.

Since the ore deposit contains both altered and unaltered ores, the mining and processing of these two types will be taken up separately in the following descriptions of methods used.

Mining Altered Ores

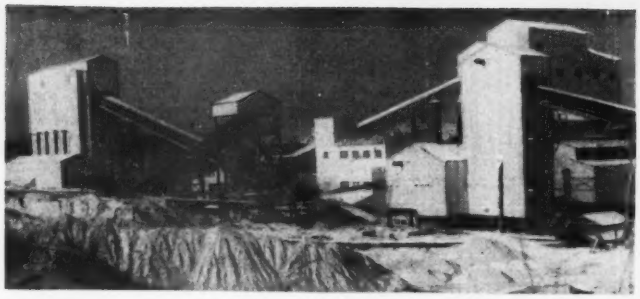
Altered ore is mined with an 85B Bucyrus Erie electric shovel, and loaded into a distributor bin equipped with movable apron feeds a belt conveyor. This conveyor carries the ore from the open-pit mine to the washing plant.

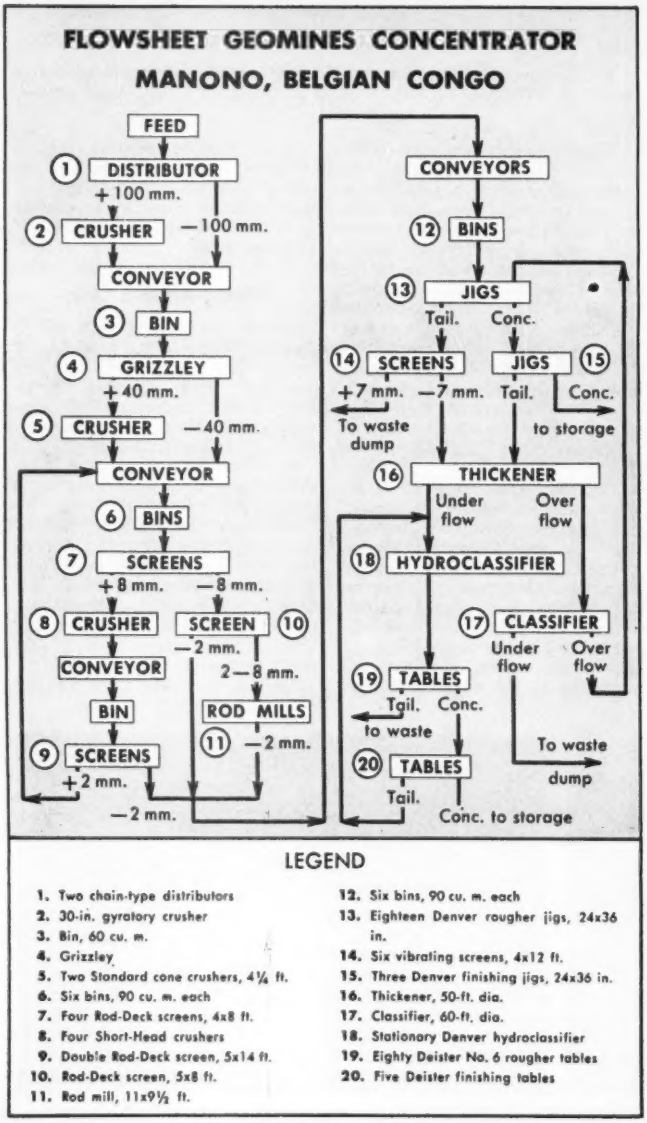
In the washing plant, mud is removed from the ore, and the cleaned product fed to Symons screens. Plus 10-mm. particles are discarded by conveyor to the waste pile. Undersize from the screens is fed to four-compartment Harz jigs which produce a cassiterite concentrate. Overflow from the washer or mud separator is processed by jigs to recover cassiterite fines.

Tailings from the Harz jigs are

for altered ores (far right).

SIDE-DUMP trailer discharges 20-ton load of tin ore.





LEGEND

1. Two chain-type distributors
2. 30-in. gyratory crusher
3. Bin, 60 cu. m.
4. Grizzley
5. Two Standard cone crushers, 4¼ ft.
6. Six bins, 90 cu. m. each
7. Four Rod-Deck screens, 4x8 ft.
8. Four Short-Head crushers
9. Double Rod-Deck screen, 5x14 ft.
10. Rod-Deck screen, 5x8 ft.
11. Rod mill, 11x9½ ft.
12. Six bins, 90 cu. m. each
13. Eighteen Denver rougher jigs, 24x36 in.
14. Six vibrating screens, 4x12 ft.
15. Three Denver finishing jigs, 24x36 in.
16. Thickener, 50-ft. dia.
17. Classifier, 60-ft. dia.
18. Stationary Denver hydroclassifier
19. Eighty Deister No. 6 rougher tables
20. Five Deister finishing tables

discharged into a thickener, and then taken to dewatering screens. Oversize from the screens goes to waste. Undersize is processed in jigs to yield a fine cassiterite concentrate, and tailings which are pumped to waste.

Mining Unaltered Ore

Blast holes for the open pit are drilled 6 in. in dia. with Ingersoll-Rand Quarrymasters, and 9 in. in dia. with Bucyrus Erie 42 T churn drills. Parallel blast holes are drilled on 17-m. benches, and extend 1.5 m. below the mining floor. In primary blasting, a score of holes is set off simultaneously. Secondary blasting is used to reduce occasional boulders to minus 30-in. size.

Bucyrus Erie 170-B shovels with 6¾-cu. yd. dippers load the ore into 20-ton Easton TP-1520 side-dump semi-trailers which discharge the ore into a 30-in. Nordberg gyratory crusher. Here the ore is reduced to 4 in.

Milling Unaltered Ore

A belt carries the ore from the pit to a 60-cu.m. bin which feeds secondary standard cone crushers. (See mill flowsheet.) Crusher discharge is 30 mm. A vibratory grizzley removes minus 30-mm. material ahead of the crusher. This undersize plus that from the standard cone are conveyed to 500-cu.m. bins. From here the ore passes through double screens, 8 mm. and 2 mm. Plus 8-mm. ore goes to 4-ft. short-head cone crushers to be reduced to 6 mm. The plus 2-mm. minus 8-mm. products then go to the rod mills. Design of the rod mills has been modified so that the ore is fed in both ends instead of one end only, and ground materials leave through a central discharge in the body of the mill. This increases the capacity of the mills.

Minus 2-mm. feed to the washing plant is stored in 750-ton hoppers which feed Denver 24x36-in. jigs working in two stages—roughing and finishing. Tails from the finishing units are recycled, while those from the rougher units are screened through 1-mm. screens. Oversize goes to waste. Undersize is deslimed in 50-ft. Denver hydroclassifiers. Underflow goes to stationary classifiers to assure a uniform feed.

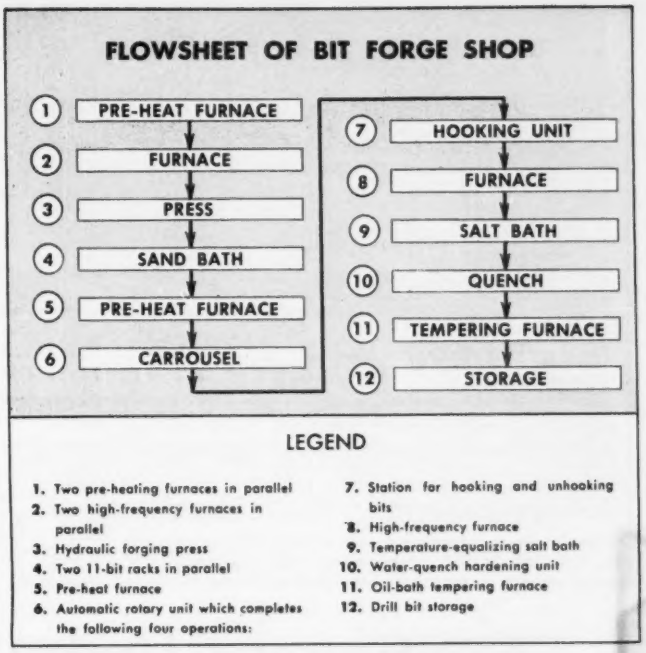
Deister concentrating tables also operate in two stages—roughing and finishing. Tails from the finishing tables are recycled, but those from the roughers go to waste.

Future Plans

When the concentrator will have reached its full capacity of 1,250 tons per hour, we shall use three primary crushers, six secondary crushers, 13 tertiary grinding mills, and six rod mills. The concentration section will require 96 jigs, four classifiers, and 120 concentrating tables.

Handling of refuse by conveyors will be supplemented by a continuous and semi-automatic dump spreading device known as a "stacking system." This will enable the last two dumping conveyors to advance on rails, and the other on crawlers. The latter will be able to sweep the dump on an almost complete circle without having to stop the plant, or to proceed to track shifting or successive extension of the conveyors.

Dry grinding employed in the mill generates considerable dust which is collected in 12 batteries of dust separators containing filter curtains. Dust particles are collected in a water-spray system. The plant for concentrating unaltered pegmatite ore has been operating since August, 1951.



Drilling Problems

Although grinding and concentrating of the ore at the outset was no cause for delay, drilling difficulties slowed up operations somewhat at the start. Owing to the hardness of the pegmatite, drilling depth with a 9-in. carbon-steel drill-bit has not exceeded an average of 0.30 m. between sharpenings, despite great care in forging, hardening, and quenching. In view of this low performance, we have conducted tests with Ni-Cr-Mo steels, and as a result have been able to increase this average from 0.30 m. to 1.75 m. Restricted quotas on nickel however, have prevented us from obtaining the quantities of drill bits required.

In view of these difficulties, we have finally purchased six Quarrymasters equipped with 6-in. Carset bits. Thus the current equipment consisting of six Quarrymasters and eight Bucyrus Erie 42 T units is adequate for carrying out the mining program which calls for the mining of about 400 cu. m. of rock or 1,000 tons per hour.

Because of the fuel shortage in Central Africa, heating of steel drill bits for reforging is an important factor to be considered. Furnaces fired with oil, which costs locally about Frs. 7.00 per kilo, make operation very costly. Taking advantage of the cheapness of electricity, we have undertaken the development of a forge shop equipped with electric furnaces. (See Flowsheet of bit forge shop.) In this shop the sequence of operations is as follows:

1. Preheating at about 500 deg. C. in a horizontal resistance furnace. Four drill bits are treated at one time in the automatic feed furnace, this being arranged so that a drill bit remains in the furnace about 25 minutes.

2. Heating at about 1050 deg. C. in a high-frequency furnace. Heating time to raise the bit to forging temperature is about 10 minutes.

3. Hydraulic press; quick operation, 15 seconds. The drill bit is reconditioned in a single operation.

4. Slow cooling of the bit in a sand bath.

5. Drill bits then pass into a preheating furnace to warm up steel gradually.

6. Drill bit then is suspended on a carrousel which performs the following four-cycle operation:

a. Hooking and unhooking the bit.

b. Heating in a high-frequency furnace at 875 deg. C.

c. Equalization of temperature in a salt bath at 875 deg. C.

d. Quenching and hardening by dipping bit in water bath.

These last operations are automatic. This is possible because each operation takes the same amount of time, about six minutes. Thus every six minutes a time relay actuates the mechanism which raises the carrousel, pivots the unit 90 deg., and then lowers the drill bits. During this six-minute interval there is ample time to unhook a quenched bit and hook a preheated bit.

Thereafter the drill bits are brought by monorail to tempering vats serving to eliminate internal stresses in the steel. Three vats are provided to accommodate the bits which remain there for two hours at a temperature of 200 deg. C.

This modern shop, operated by natives, is remarkably foolproof and prevents errors in processing. All electric furnaces are equipped with automatic controls which limit the temperature to the proper degree, thereby preventing harmful overheating.

In summary, it might be mentioned that reserves of tin-bearing ore at Manono are sufficiently large to justify the present economical large-scale mining program.

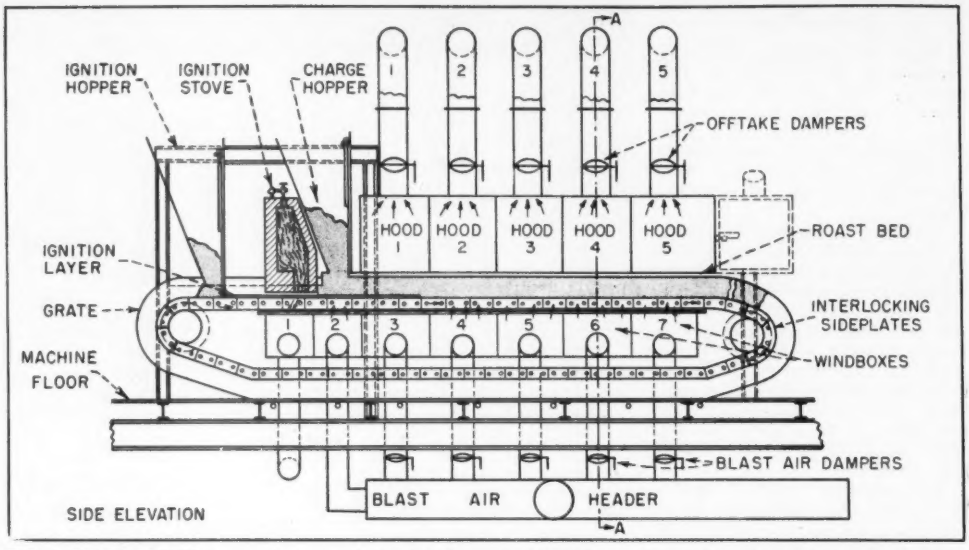


FIG. 1. PILOT PLANT for continuous updraft sintering permits one-pass roasting and offers faster production rate of sinter of a grade equal to that of conventional downdraft machines.

Continuous Updraft Sintering

Updraft Process also means greater capacity, less corrosion.

W. R. BURROW, Broken Hill Associated Smelters Pty. Ltd., Port Pirie, South Australia

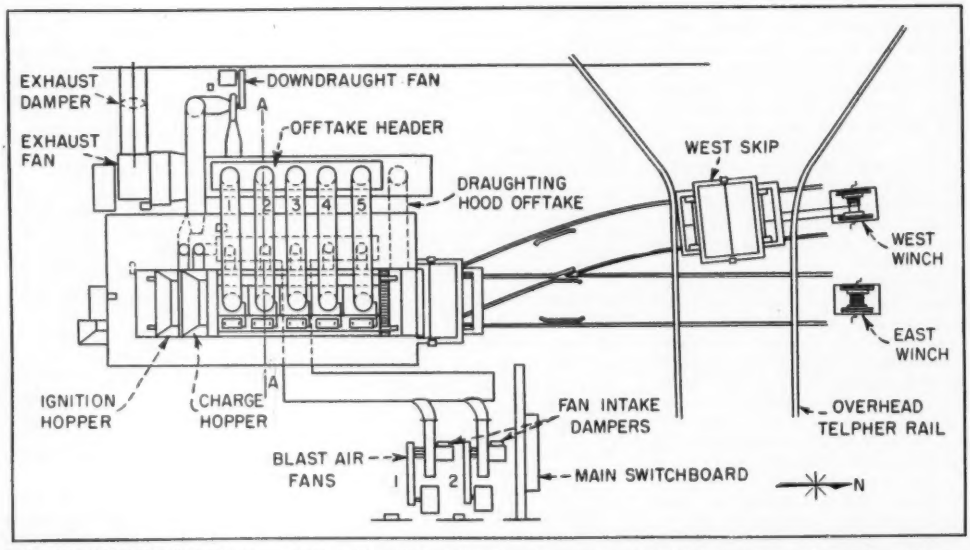


FIG. 3. PILOT PLANT will be model for 10 x 77-ft. full-scale unit that will treat total plant output for 160,000 long tons of market lead per year and sufficient SO_2 for 50,000 long tons of 98% H_2SO_4.

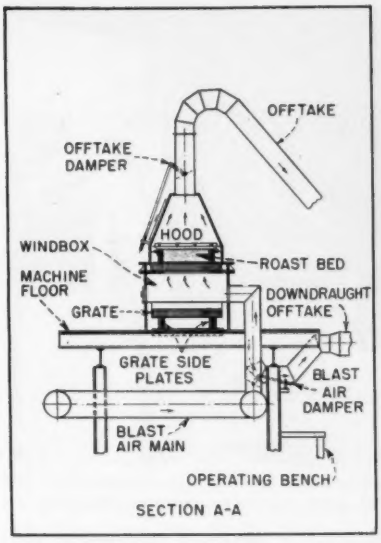
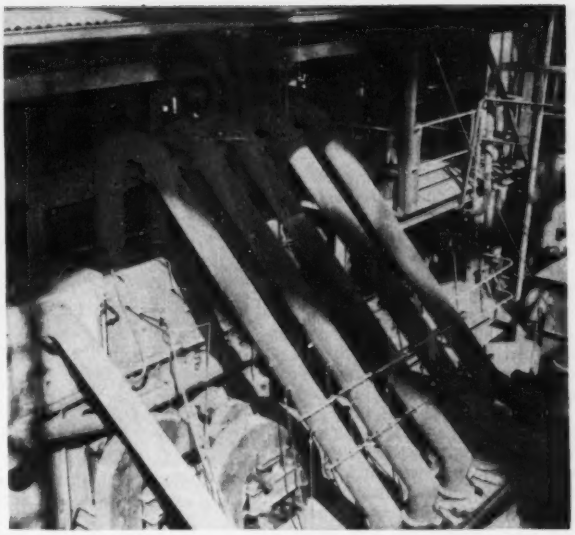


FIG. 2. GREATER concentrations of SO_2 are possible in updraft process.



FLUE GAS OFFTAKES show less corrosion with updraft sintering because higher temperature keeps SO_2 above the dew point.

Recovers More SO_2 for Smelter

RESEARCH INTO WAYS OF PREVENTING precipitation of metallic lead in the Dwight Lloyd sinter machine has led Broken Hill Associated Smelters (Australia) to the development of a continuous updraft sintering process. In pilot plant operation, not only was lead fall eliminated, but a higher concentration of SO_2 gas has been obtained for easier treatment in the acid plant, a one-pass roast has been made possible, and the rate of sinter production is considerably greater. A full-scale machine for the process is scheduled for operation in 1954.

Updraft sintering is not new; it was developed as a batch process at the end of the nineteenth century when the smelting of sulphide ores became necessary. Various investigators patented continuous updraft sintering apparatus (1), (2), (3), (4), (5) but apparently no commercial processes resulted from the work. About the same time, A. S. Dwight and R. L. Lloyd developed the continuous downdraft process which rapidly superseded the batch updraft processes and is now the generally accepted method of sintering. Over the years, changes have been made to the downdraft method for improvement in lead production but apart from some work on gas recirculation, little had been done on by-product sulphur recovery.

TABLE I—The Pilot Sinter Machine Dimensions

Effective machine length	12.17 ft.
Bed width	2.0 ft.
Effective grate area	24.33 sq. ft.
Hood area	20.00 sq. ft.
Bed depth	7.5 in.
Grate speed	8 to 20 in./min.

However, altered world economic conditions have made recovery of sulphur a matter of paramount importance. In U. S. A., Britain and Belgium, the sulphur recovery problem has been attacked by refinement of the conventional downdraft process and recirculation of the effluent gases to obtain an acid plant gas containing as high a proportion of the eliminated sulphur as possible.

It was realized that there was a potential sulphur source in the sinter plant gases at Port Pirie which would help overcome Australia's sulphur shortage and methods of utilization were studied. However, before gas of contact acid plant grade could be achieved, it was necessary to overcome some local problems confronting us.

The sinter plant at Port Pirie consists of two modern 10 ft. x 55 ft. D.L. machines which "semi two-pass" sinter a 75% Pb concentrate using a proportion of recirculated "return" sinter (6). When on normal production of 1200 long tons of 45% Pb sinter per day, the process produces 100-120 long tons per day of precipitated lead in the windboxes. Metallurgical practice, at the time of construction of the plant, favored a high lead fall and process developments were planned accordingly without consideration of the by-product sulphur recovery. The frequent removal of windbox lead has rendered maintenance of suitable acid plant gas difficult. Application of recirculation techniques was unfavorable because of possible production loss in the plant which works near maximum capacity.

A considerable amount of experimental and plant scale work was done on these problems and

by 1949 it appeared feasible to produce a suitable gas. A decision was then made to construct a gas purification train and contact acid plant.

Updraft Sintering Experiments

Concurrent with the progress of the plans for the acid plant, the Research Department embarked on a study of sintering processes. The principal aim was the elimination of lead fall. Stationary bed roasting experiments using an upward draft gave promising results. It was shown that the expected difficulties could possibly be overcome, provided a continuous process was developed.

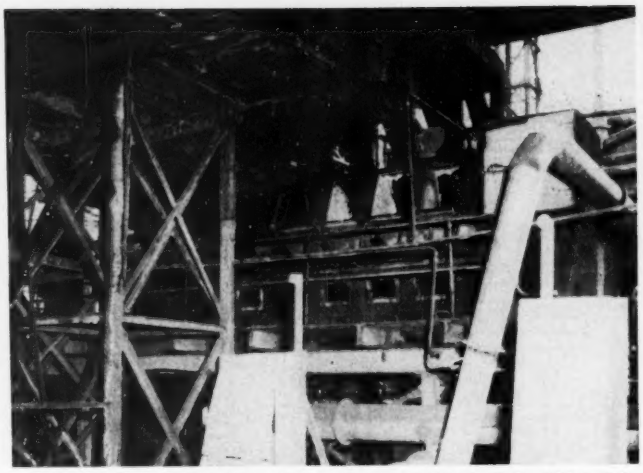
Experiments proved that a normal D.L. charge could be effectively sintered with a rapid sulphur elimination and without the production of windbox lead. The reduced lead remained entrapped in the sinter cake. The SO_2 concentration was higher than for equivalent downdraft charges and a higher proportion of eliminated sulphur was present in gases of acceptable SO_2 concentration.

Charges roasted faster when updrafted, indicating a possible increase in production rate. Figures 5 and 6 are typical results of laboratory experiments.

A laboratory study of ignition techniques proved that satisfactory ignition could be obtained by a downdraft-updraft method. In this, the upper surface of a thin layer of charge material was ignited under a downdraft, after which the remainder of the charge was added and the direction of airflow reversed. The technique was developed on a small hand operated experimental unit illustrated in Fig. 4.

The Pilot Plant Development

Success of the preliminary experiments stimulated interest and all available effort was directed towards developing a workable continuous process. A 50-ton per day pilot plant was constructed from an old boiler stoker grate and second-hand material available at the Works. (See Figs. 1, 2, 3.)



PILOT SINTER MACHINE has effective length of 12.17 ft. Bed width is 2 ft. and effective grate area 24.33 ft. Hood and windbox doors are open here.

The moving grate received a shallow layer of charge from the ignition stove where it was ignited using a downdraft induced in the first windbox. Immediately after passing beneath the ignition stove additional charge of the same material as the ignition layer was fed from the roast hopper and the total bed formed. Air was then blown in under pressure in the remaining windboxes.

The charge sintered from the bottom upward and the hot gases were collected in the hoods. Effluent gas volumes and hood pressures were controlled by individual offtake dampers above the hoods. The sintered product was discharged directly into a telpher skip for removal to a stockpile.

The pilot plant commenced operation on Sept. 6, 1949, and after four months of modifications and improvements, it was established on a 24-hourly operating basis.

The pilot plant operated during the period Jan., 1950, to April, 1951, and produced a total of 12,500 tons of sinter, 8,000 of which was stockpiled and smelted in two blast furnace campaigns. This sinter did not cause any difficulties in blast furnace operation and furnace behavior was similar to that when treating normal D.L. sinter.

The pilot plant feed consisted of 50% normal day to day D.L. feed and 50% "return sinter." The D.L. feed was Broken Hill concentrates and the fluxes required for the blast furnace charge. Return sinter was crushed fines from updraft sinter screening.

The "return sinter" was recirculated with the object of reducing the new feed sulphur tenor and preparing the charge in a physical condition suitable for one-pass sintering.

Tables 2 and 3 present typical pilot plant data for a production rate of 0.09-0.095 tons of new sin-

TABLE II—Charge and Product Data

Raw Feed %	45
Crushed Sinter %	55
Return sinter sizing	Minus 0.5 in.
Ignition bed depth inch	1.0
Total bed depth inch	7.5
Total sulphur in Feed %	6.6
Total sulphur in Product %	1.5
Sulphur elimination %	79.5

TABLE III—Bed Pressure and Effluent Gas Conditions Along the Machine

Offtake No.	SO_2 %	Gas Temp. °C	Gas Volume CFM@NTP per sq. ft. Grate area	Bed Pressure Drop Ins. W.G.	Gas Pressure in Hood Ins. W.G.
1	6.7	80	135	12.0	—0.1
2	6.0	200	125	13.0	—0.15
3	2.0	400	180	11.5	—0.20
4	0.2	505	195	12.0	—0.30
5	—	360	215	11.5	—0.35

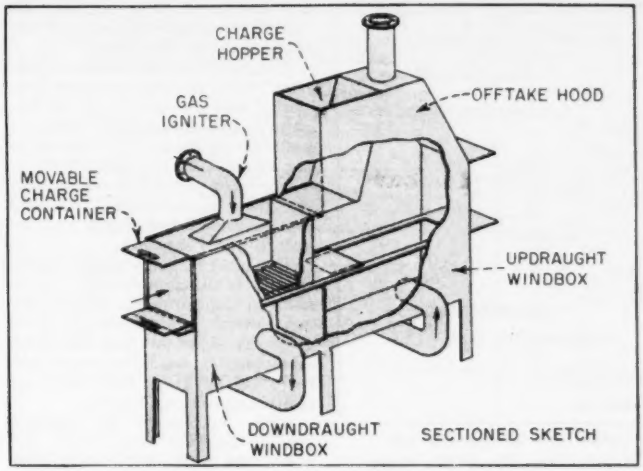


FIG. 4. EXPERIMENTAL ignition unit provides for igniting thin layer of charge under downdraft. Remaining charge is then added and air flow is reversed.

ter per square foot of grade area per hour.

Important facts established from the pilot plant operation were:

(a) Precipitation of windbox lead was eliminated. The reduced lead remained entrapped in the sinter cake.

(b) A one-pass roast was possible. One-pass sintering has always been a goal, but has never been satisfactorily developed by D.L. downdraft sintering at Port Pirie.

(c) Sinter production rate was considerably greater than for the downdraft process. The pilot plant proved to have a production rate, per unit of grate area, of at least 1.5 times that of the downdraft process.

(d) A by-product gas of better than 5.5% SO_2 could be readily produced. The SO_2 concentration of offtake gases from the corresponding first set of windboxes was higher than for downdrafting. In addition to the more rapid SO_2 evolution rate, the process offered an opportunity of easily maintaining a balanced pressure in the offtake hoods by using automatic damper control. Thus the ingress of diluent air could be readily prevented and a higher average SO_2 concentration be maintained.

(e) The updraft process produced a sinter of quality equal to that of the downdraft process.

(f) Approximately 80% of the eliminated sulphur was available in gas of 5.0% SO_2 or better.

(g) Fume and dust burden in the flue gases showed no marked variation from that of downdraft process gases.

(h) Flue corrosion and machine maintenance should be less than with downdraft. The gases from the updraft process were much hotter than those of the downdraft D.L. Corresponding maximum temperatures, about two-thirds along the length of the machines, were 600 deg. C. versus 250 deg. C. The marked increase was considered due to reduction in amount of cooling "false air" in the offtake gases and more efficient fuel utilization as evidenced by the increased production rate. Higher temperatures should keep most gases above dew point.

In addition the grates and machine frame were not subjected to the same corrosive and temperature conditions as in downdrafting. After the short ignition period cooling of the grates was effected by blast air.

Comparison of the Updraft and Downdraft Processes

In both updraft and downdraft processes, roasting characteristics of the charge bed are determined by charge composition and bed permeability.

A typical sintering charge is composed of:

(a) Raw feed
(b) Return material
(c) Moisture

"Raw feed" is the lead sulphide concentrates and the flux materials required for subsequent blast furnace treatment.

"Return material" is a proportion of the plant product which is crushed and recirculated to control the sizing and sulphur content of the charge and act as a heat diluent. By adjustment of the proportions, a charge can be roasted to a sintered product, with the required sulphur elimination, in the one operation—a "one-pass" roast.

The proportion of added moisture controls the bed permeability and subsequent roasting rate. It also functions as a heat diluent.

Bed permeability is determined by:

(a) Charge particle size and distribution within the bed;
(b) Moisture content;
(c) Method of charge preparation.

When a charge is downdrafted, the bed, prior to ignition, shows no appreciable compaction. Immediately the surface is ignited and a roasting zone established the bed surface is depressed, permeability decreases, and the roasting rate is retarded. Water is evaporated from the roasting zone and condenses in the basal layer. Condensate increases the charge moisture content and tends to break down the particle aggregates, and so further decreases bed permeability and retards roasting. In a properly moistured charge, the particle aggregates contribute in a large measure to bed porosity. As the roast proceeds, reduced lead, charge fines, and fused material accumulate and the basal layer tends to blind the grate apertures, further inhibiting the roast. This factor becomes increasingly important with increase in bed depth, but can be partly overcome by promoting preferential segregation of the coarser charge particles to the basal section of the bed.

In the case of an updrafted charge, the bed suffers no initial compaction after ignition and the upward gas flow tends to keep the charge bed apertures open. The moistened aggregates, i.e., small charge particles adhering to one another due to the surface tension of the water film, are not subjected to the same compressive forces and retain their porosity even though condensation does occur. The reduced lead and fused materials are frozen in situs by the relatively cool counter-current stream of air and do not blind the grate. The net result is that a higher volume of air is available in the roasting bed per unit of time and a more efficient roasting results.

A comparison of actual experi-

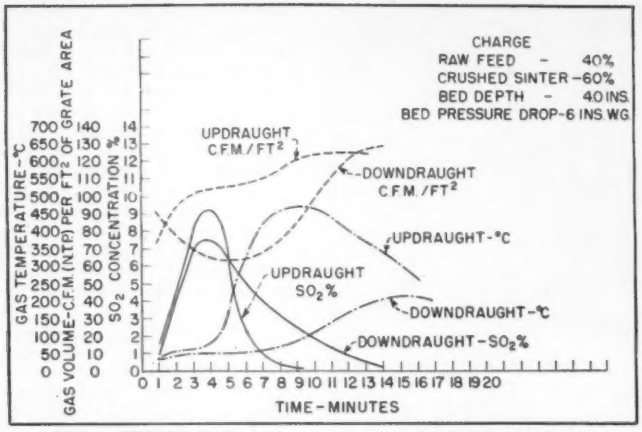


FIG. 5. EXPERIMENTAL sintering results with bed depth of 4 in.

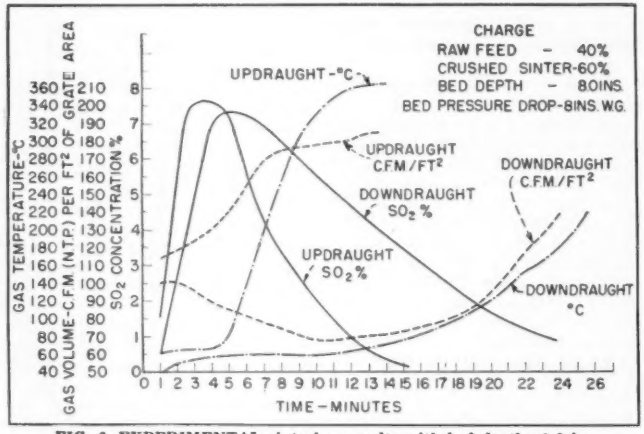


FIG. 6. EXPERIMENTAL sintering results with bed depth of 8 in.

mental roasting data is given in Fig. 5 and 6 and clearly illustrates the differences.

The updraft process, however, has its limitations.

(a) The volume of air passing through the bed is related to bed pressure drop and the bed pressure drop must be maintained at a value below which physical disruption of the bed will occur. Therefore, roasting rate is controlled by the bed pressure drop or resistance.

(b) The bed must be homogeneous with respect to permeability and fuel distribution. Feed segregation must be avoided.

(c) The roasting zone must be uniformly established, i.e., there must be a high ignition efficiency.

Maintenance of uniform bed permeability is, of course, a most important factor but this presents no real difficulty with the knowledge now available for controlling the physical properties of the charge bed by recirculation of sinter and moisture conditioning.

When the investigation commenced, the ignition of the moving bed at the grate charge interface was a problem. The downdraft updraft method was developed and has been completely satisfactory on the pilot plant.

Conclusion

The laboratory experiments and pilot plant development have shown that the updraft process has numerous advantages over the conventional downdraft process, particularly where the effluent gases are required for sulphuric acid manufacture.

Complete elimination of lead fall has been the greatest single contribution and will have advantages in many directions.

The ability to operate on a "one-pass" roast ensures complete flexibility and independence of machines and will be of value in maintaining continuity of gas supply to the contract acid plant.

Improved production rate resulting from more efficient roasting and increased bed depth will increase plant capacity.

The method has possible applications to other materials as well as lead concentrates. Laboratory experiments conducted at Port Pirie have shown that excellent sinter and a high-grade gas can be obtained from zinc sulphide concentrate by updrafting.

When success of the updraft process appeared assured, a decision was made during early 1950 to construct a full-scale experimental updraft machine. The design of this machine has progressed with the pilot plant investigation and to date a complete design has been prepared and construction commenced. The aim is to have the machine installed and operating by early 1954.

The machine will be 10 ft. x 77 ft., capable of treating the total plant throughout for approximately 160,000 long tons of market lead per year and producing sufficient high strength gas to operate the new contact acid plant to produce 50,000 long tons of monohydrate or 98% H_2SO_4 per year.

The machine is designed primarily as an experimental unit, and when the full operating technique is established, the two existing D.L. machines will be converted in turn to updraft. When conversion is complete, the sintering operation will be conducted on two machines as before.

Acknowledgements

The author is indebted to the management of the Broken Hill Associated Smelters for permission to publish this paper.

The author's thanks are also due to the members of the research and operating departments, who have contributed so much to the success of the development.

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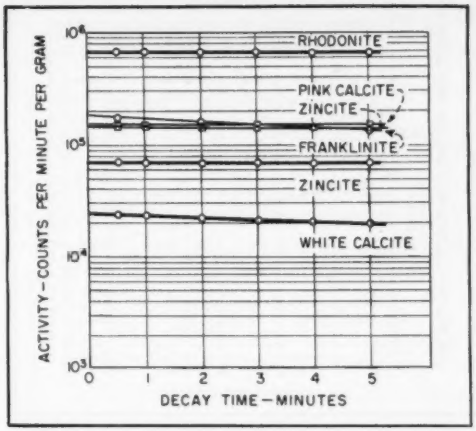
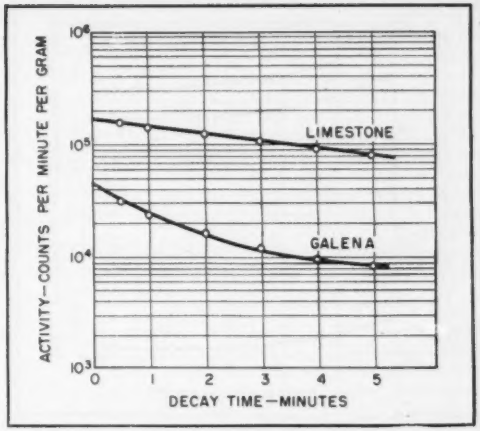


NEW JERSEY ZINC'S Franklin, N. J., ore minerals could be separated on basis of initial induced radioactivities.



ST. JOSEPH LEAD CO.'S Missouri ore shows 10:1 difference between galena and limestone's activities.

Measurement of artificially-induced gamma radiation in ore from these mines shows

How Induced Radioactivity May Help Separate Minerals

A. M. GAUDIN[a], F. E. SENFTLE[b], W. L. FREYBERGER[c]
Cambridge, Mass.

BOMBARD a mineral with neutrons (for example, by placing it in a nuclear reactor), and an artificial radioactivity is induced in the mineral. Beta and gamma radiations are given off thereafter at rates that vary for different minerals. The initial level of activity of this induced radiation is also different for different minerals.

Because each mineral has a specific level and rate of induced radioactivity, except for variations caused by impurities, it becomes possible to consider separating minerals by a technique based on this fact. The following report tells how induced radioactivity varies among the more common minerals, and how these differences might be applied to separating them.

THE EDITORS

IT HAS BEEN PROPOSED[1] that minerals be separated from one another on the basis of radioactivity induced in them by neutron bombardment. Kaufman[2] has described a separating device, now in use at Port Hope, Canada, which "picks" uranium-bearing particles from a moving line of particles on the basis of natural radioactivity. It has also been[3] shown that beryl may be separated from other minerals by irradiating the mixture with gamma or x-rays and actuating a picking mechanism with the neutrons ejected from the beryllium nuclei.

The uranium and beryl processes are quite selective. In the first, only minerals of uranium and thorium have sufficiently high natural activities to be detected. In the second process, by a proper choice of the energy of the x-radiation, only beryllium will lose a neutron and be detected. On the contrary, a process in which minerals are separated after bombardment by slow neutrons is not limited to sorting the minerals of one or two elements. In fact, it may be fair to say that the process is of a general character since all elements, and therefore all minerals, become active to some degree.

From published tables[4] it is possible to calculate activities induced in elements by neutron irradiation. Knowing then the chemical composition of a pure mineral species, it is possible to calculate the expected activity of that mineral after irradiation. Minerals as found in nature, however, are rarely pure chemical compounds, but contain finite amounts of impurities, even in single crystals.

In order to gain direct knowledge of the radioactive behavior of minerals, an extensive series of tests was run at the Brookhaven National Laboratory, using the nuclear reactor as a neutron source and measuring the induced beta and gamma activities. One hundred and fifty specimens of 51 mineral species were studied. For each mineral the observed activity was compared

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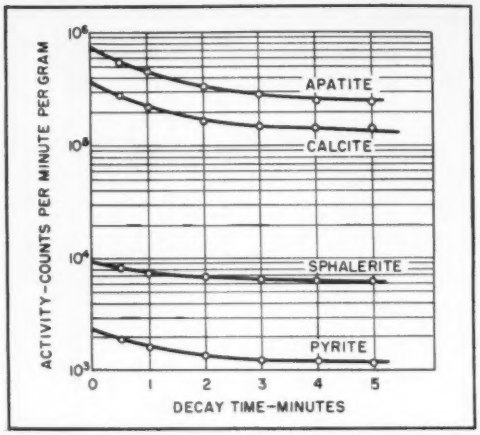
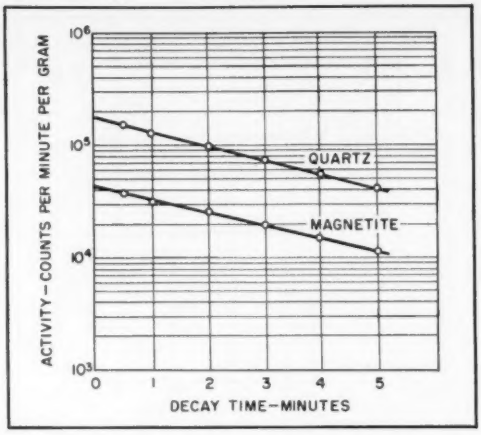
[1]For references, see bibliography at end of article.



ST. JOSEPH LEAD CO.'S Balmat, N. Y., ore shows possible separation of sphalerite from apatite, or calcite, and even pyrite, based on initial activities, not rates of decay.



ALAN WOOD STEEL CO.'S Scrub Oaks, N. J., ore shows interesting 4:1 activity difference between magnetite and quartz that might allow separation at coarse sizes.

to a calculated value for the appropriate pure chemical compound. In addition, the activities obtained for each of the several specimens of the same species were compared to each other. As might be expected, minerals containing copper, silver, manganese and aluminum gave the highest activities. Many combinations of minerals were found to have activity differences which should make separation feasible.

When the activity of the species was compared with the calculated value, deviations were found which were smaller for species with relatively high calculated values than for those with low values. This effect may be accounted for by the presence of trace impurities in the minerals. In general, the measured activity was higher than the calculated activity. It had been anticipated that selective detection could be based not only on the initial level of the activity attained, but also on the different rates at which the activity would decay. For different minerals out of the same orebody this has not been realized up to now, possibly because the minerals contain the same principal elements and/or impurities even though in different proportions.

Experimental Procedure

Sample Preparation — Mineral specimens were collected with two purposes in mind. First, it was desired to test specimens of common ore minerals and gangues. This was done to explore the possibility of separation on commercial orebodies. Secondly, wherever possible, samples of each species were taken from various geographic locations in order to evaluate the range of activities each mineral could have. In a few cases, suites of mineral species from a given mine were collected.

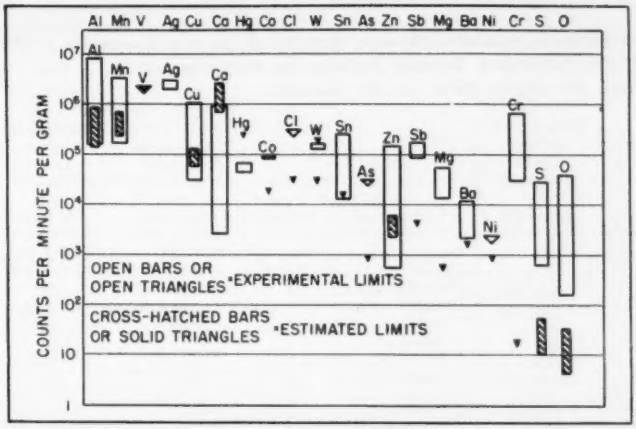
The collected specimens were purified in several ways. The first step in all cases was to crush the specimens and screen out the 65/100-mesh portion for further treatment. Cleaning was then accomplished by use of the Superpanner or the Frantz magnetic separator[5] or by hand picking under the microscope, but not by heavy liquids, usually containing easily activated bromine or iodine. Most of the samples were prepared by the use of a special device for sorting under the microscope.[6] Only those grains of a single mineral were picked which appeared to be free of mechanically attached impurities. About half a gram of each pure mineral was required. Two samples of each specimen were prepared, one for beta-activity and the other for gamma-activity measurements.

The samples for beta counting were prepared by spreading a weighed amount of mineral particles on a small polystyrene planchet, the surface of which had been previously softened with a solvent. After the surface had hardened again, the entire planchet was protected with a thin collodion film. The planchets were about 7/8 in. x 7/8 in. x 1/8 in. in size and weighed about 2 grams. The amount of mineral used was varied according to the estimated activity for the mineral. The amount taken was not less than 75 micrograms nor more than 50 mg.; the lower limit was imposed by the accuracy of the analytical balance used and the upper limit by the area of planchet.

The samples for gamma counting were prepared by placing a weighed amount of mineral in a small gelatin medicine capsule weighing about 40 mg. Because of the lower efficiency of the G-M tube when counting gamma activities, about 200 mg. of mineral was used for each sample.

Irradiation of Mineral Specimens —The prepared specimens were taken to the Brookhaven National Laboratory to be irradiated in the nuclear reactor. Irradiations were made using the pneumatic tube system built into the reactor.[7] The time of irradiation was set for 2.5 seconds. The neutron flux was not constant for every run, but all results were normalized to a definite flux (in the range of 10^{12}-10^{13} n/cm^2/seconds).

Determination of Counting Rate —Determinations were made of the initial activity and also of the rate of decrease in activity during a five-minute interval after irradiation. The counting rates were measured in the following manner: After determining the background counting rate, a sample was irradiated and then transferred as quickly as possible to a tray holder


Al Mn V Ag Cu Co Hg Co Cl W Sn As Zn Sb Mg Ba Ni Cr S O
COUNTS PER MINUTE PER GRAM
OPEN BARS OR OPEN TRIANGLES *EXPERIMENTAL LIMITS
CROSS-HATCHED BARS OR SOLID TRIANGLES *ESTIMATED LIMITS

ACTUAL vs. CALCULATED induced radioactivities for minerals grouped under one element (See Table 2, p. 98). Open bars give range of test results; cross-hatched bars give estimated ranges. (See text at right below.)

for counting. The "delay time" (of the order of 40 seconds) between the end of irradiation and the start of counting was measured to enable extrapolation of the final curve of activity versus time to "zero" delay time. This datum was necessary, also, to make the measurements on all minerals comparable. When the sample was in position for counting, the counting cycle was begun. The cycle consisted of a 15-second counting period followed by a 15-second pause during which the count was recorded and the scaler was reset. The cycle was repeated for a total of five minutes. The method used gave only an approximation to the instantaneous counting rate. This is because each counting period extended over a period of time in most cases long enough to be appreciable when compared with the half-life of the decaying nuclei.

For beta counting, the sample was placed at a fixed distance below the end-window GM tube having a window thickness of 2 mg/cm². For gamma counting, lead absorbers were placed over the tube. The thickness of lead used in each case was calculated to stop the most energetic beta ray expected from the elements composing the pure mineral. The minerals studied in these tests divided themselves conveniently into two major groups plus one minor group so that only three different absorbers were required. The major groups were sulphur-bearing and oxygen-bearing minerals. The maximum beta ray energy of oxygen is 4.5 Mev. and of sulphur 4.3 Mev.[5] The absorbers used were 3084 mg/cm² for oxygen and 2640 mg/cm² for sulphur. In addition, two minerals which contained fluorine required for that element an absorber of 3316 mg/cm².

Experimental Results

It was necessary to make several corrections on the data as recorded at Brookhaven before the final results could be tabulated. These corrections (coincidence loss, flux variation, background, etc.) are summarized in Appendix I.* In the final form the data for each sample were plotted on a graph of log activity (counts per minute per gram of mineral) versus elapsed time.

Even in their final condensed form, the data are so numerous and bulky as to be easily a source of confusion to a reader. To increase the utility of the data, the presentation is made in five tables in Appendix II which are the prime record of our experimental work. These tables present the measurements of sulphide minerals (Table A), oxides and hydrous oxides (Table B), silicates (Table D), other oxide minerals (Table C), and halide minerals (Table E). The activities observed range up to billions of counts per minute per gram. To facilitate the use of the tables, the gamma activities are presented in terms of thousands of counts per minute per gram and the beta activities in terms of millions of counts per minute per gram. The source of each mineral, whenever known, is given. The tables give the activities at 30 seconds after irradiation, 2.0 minutes after irradiation, and 5.0 minutes after irradiation. These times were selected as representative of times at which industrial separations might be made.

To bring out the major observations without the detail, the reader is referred to Table I in which the theoretical activities of the 51 minerals and the range of observed activities are given side by side. This table is for gamma activity only, as we felt these results were more reliable than the beta measurements which were marred by the relatively high activity acquired by the planchet.

It is possible to select the element in each mineral which contributes the major portion of the calculated activity. As an example, copper produces the most important activity in the minerals azurite, bornite, chalcocite, chalcopyrite, chrysocolla, enargite, malachite, stannite and tetrahedrite. All of the minerals can then be grouped according to the element which, in theoretically pure minerals, produces the most activity. The subgroups can be classified further according to the intensity of their gamma radiation. Table II is a list of the 51 minerals studied grouped according to these two factors. To further clarify the construction of this table, it may be noted that chalcocite appears as a copper mineral, group 1, while galena appears as a sulphur mineral, group 4. Likewise, pyrolusite appears as a manganese mineral, but hematite as an oxygen mineral.

Table F, Appendix III, is a condensation of the prime data. For each element in this table is listed the range of calculated activities for the minerals grouped under that element. The experimental activities are also given. As an example, in the case of copper, the estimated activities of the nine minerals listed above range between 68 kilo cpm/g. for stannite to 160 kilo cpm per g. for chalcocite; the experimental values are larger, ranging from 32 to 1100 kilo cpm/g.

The data of Appendix III are presented in the cut above. The estimated limits of gamma activity for all of the minerals listed for a given element are represented

*Appendices omitted on space considerations. To obtain data, see note at end of article.

Table I — Comparison of the Experimentally Measured Gamma Activity of Various Specimens of the Same Mineral with the Calculated Gamma Activity for that Mineral; Activities for Decay Time of 30 Seconds.

Mineral	Number of Specimens Studied	Calculated Activity Thousand cpm per Gram	Experimental Activity Limits Thousand cpm per Gram
SULPHIDE MINERALS			
Arsenopyrite	1	1.0	32
Bornite	3	130	41 to 320
Chalcocite	2	160	130 to 210
Chalcopyrite	1	71	37
Cinnabar	4	290	45 to 72
Enargite	1	100	1100
Galena	7	0.012	0.13 to 220
Proustite	1	3600	2100
Pyrite	5	0.056	0.61 to 2.0
Pyrargyrite	1	3300	3200
Pyrrhotite	1	0.039	130
Smaltite	2	22	84 to 94
Sphalerite	5	5.3	4.5 to 74
Stannite	1	68	120
Stibnite	3	4.8	93 to 190
Tetrahedrite	2	110	380 to 430
OXIDE AND HYDROUS OXIDE MINERALS			
Bauxite	3	950	850 to 2000
Cassiterite	4	180	13 to 260
Chromite	3	0.019	56 to 670
Franklinite	1	300	180
Hematite	6	0.005	14 to 110
Ilmenite	1	0.005	72
Magnetite	6	0.005	17 to 240
Psilomelane	2	580	300 to 6400
Zincite	2	6.3	73 to 150
OXYGEN MINERALS EXCEPT OXIDES HYDROUS OXIDES, AND SILICATES			
Apatite	4	2000	28 to 580
Azurite	5	110	98 to 750
Barite	4	2.2	2.3 to 11
Calcite	11	2000	2.7 to 300
Carnotite	1	2500	2600
Cerussite	2	0.034	1.7 to 26
Dolomite	4	1100	9.1 to 110
Ferberite	3	37	170 to 770
Gypsum	2	1300	3.2 to 7.0
Limestone	1	2000	160
Magnesite	2	0.66	14 to 59
Malachite	3	120	150 to 230
Rhodochrosite	3	540	220 to 3500
Scheelite	3	780	18 to 36
Siderite	3	0.009	34 to 140
Smithsonite	3	4.0	0.56 to 76
SILICATE MINERALS			
Chlorite	1	150	9200
Chrysocolla	4	73	32 to 410
Feldspar	10	370* 1100**	440 to 760
Garnet	4	no exact chemical composition	170 to 300
Garnierite	1	1.1	2.4
Quartz	7	0.008	8.0 to 400
Rhodonite	1	470	700
Wollastonite	0	1740	
HALIDE MINERALS			
Fluorite	6	2800	49 to 960
Halite	1	67	300

*Based on K—feldspar.

**Based on Ca—feldspar.

Table II — Minerals Arranged According to the Elemental Activities, i.e., the Element with the Most Predominant Activity for Each Mineral

Element	Mineral
1. GAMMA EMISSION ABUNDANT	
Al	Garnet, K—Feldspars, Bauxite, Chlorite
Mn	Psilomelane, Rhodonite, Wolframite, Rhodochrosite, Pyrolusite
V	Carnotite
Ag	Pyrargyrite, Proustite
Cu	Chrysocolla, Chalcocite, Azurite, Chalcopyrite, Malachite, Bornite, Tetrahedrite, Stannite, Enargite
Ca	Apatite, Fluorite, Calcite, Ca—Feldspars, Dolomite, Scheelite, Gypsum
Hg	Cinnabar
Co	Smaltite
F*	
2. GAMMA EMISSION MODERATE	
Cl	Halite
W	Ferberite
Sn	Cassiterite
As	Arsenopyrite
Na*	
3. GAMMA EMISSION WEAK	
Zn	Smithsonite, Sphalerite, Zincite
Sb	Stibnite
Mg	Magnesite
Ba	Barite
Ni	Garnierite
4. GAMMA EMISSION NEGLIGIBLE	
Cr	Chromite
S	Pyrrhotite, Galena, Pyrite
O	Quartz, Cerussite, Siderite, Magnetite, Hematite
K*	
H*	

*There are no minerals in which these elements have a predominant activity.

by the ends of the narrow cross-hatched bars. In the case of the elements for which only one mineral is listed, a solid triangle has been constructed for clarity, the top bar of the triangle representing the calculated activity. The wide, open bars present in the same way the experimentally determined limits of activity for the minerals grouped under one element. Again if only one specimen was studied, a triangle is used. The data plotted for Ni are typical of the case of studying one speci-

men of one mineral. The data for Sb and Sn are examples of the case where several specimens of one mineral were studied. The bars for Cu show the case in which several specimens of each of several minerals were studied.

Discussion of Results

Accuracy—The results of the measurements of gamma activity are of a semi-quantitative nature. No absolute error may be assigned to any single result or set of results, but an estimated value of the average error taking all measurements together would be about ± 30%. The major sources of error were weighing error, ± 15%; irradiation time error, ± 10%; counting errors, ± 5%; errors involved in correcting the data, ± 10%.

A more serious error, indeterminate in nature, arose in measuring the beta activity of the minerals. It was found that the polystyrene mounts became active to the order of about 5000 cpm per gram. This activity was often higher than that of the mineral and was not satisfactorily reproducible between different blank planchets. Therefore, the results given for the beta activities should probably be considered as having only order-of-magnitude significance.

Table III — Decay Characteristics of Natural Minerals Made Artificially Radioactive

Mineral	Theoretical Decay: Half-Life	Theoretical Decay: Element	Experimentally Measured Decay: Experimental Half-Life: Initial Activity	Experimentally Measured Decay: Experimental Half-Life: Later Activity	Experimentally Measured Decay: Probable Major Element: Initial Activity	Experimentally Measured Decay: Probable Major Element: Later Activity
Bauxite	2.4 min.	Al	(3)* 2.7 min.		Al	
Bornite	4.3 min.	Cu	(1) 7 min.		Prob. Cu	
			(1) 10-15 sec.	4 min.	Ag	Cu
			(1) 25 sec.	4 min.	Ag	Cu
Cassiterite	9.5 min.	Sn	(3) 4.5-5.5 min.		Cu	
Fluorite	12 sec.	F	(6) 10-20 sec.	25 min.	F	Ca?
Galena	5 min.	S	(5) 20-25 sec.		Ag	
Gypsum	8 min.	Ca	(2) 2.5 min.		Al	
Hematite	long	Fe	(6) 2-5 min.		Al	
Magnesite	10 min.	Mg	(1) 2.8 min.		Al	
Magnetite	long	Fe	(4) 2-5 min.		Al	
Pyrargyrite	23 sec.	Ag	(1) 25-30 sec.		Ag	
Pyrolusite	2.6 hrs.	Mn	(2) >1 hr.		Mn	
Siderite	long	Fe	(3) long		Fe	

*Numbers in parenthesis are the number of specimens whose half-lives were determined.

Table IV — Beta and Gamma Activities of Industrial Diamonds

Diamond Color	Gamma Activity* (Thousand C.P.M. per Gram): 0.5** min.	2.0 min.	5.0 min.	Beta Activity (Thousand C.P.M. per Gram): 0.5** min.	2.0 min.	5.0 min.
White	nil	nil	nil	19	6.8	△
Yellow	nil	nil	nil	18	6.6	△
Gray	nil	nil	nil	98	45	20
Black	530	170	△	2000	870	410
Blue	390	78	60	180	77	34

*Activity measured using absorber 220 mg/cm².
**Time elapsed after irradiation stopped.
△Counting error too large due to high background.

Interpretation—Because of the more serious errors involved in measuring the beta activities, the following discussion will deal mostly with the results of gamma activity measurement. In general, however, the same things are shown by both measurements.

The most apparent feature is the wide range of activities not only between different minerals, but also in some cases between various specimens of the same mineral. This is particularly evident from Table I, Appendix I, and the cut on p. 97. The highest gamma activity measured was 10^7 cpm/g. for chlorite, the lowest, about 10^3 cpm/g. for several minerals. Also, samples of galena showed activities ranging from 10^3 to 5×10^5 cpm/g. as did the samples of calcite.

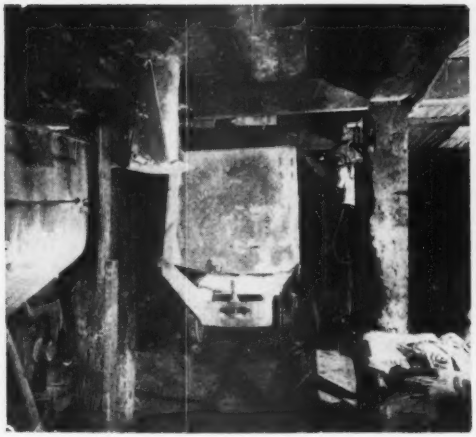
It can be seen also from the cut on p. 97, that, in general, the minerals showing the largest spread of activities are those whose calculated activities are low. These same minerals also show the greatest deviation between experimental and calculated activities. Conversely, minerals for which the calculated activity is high show less deviation between calculation and experiment and a smaller spread in activity. Qualitatively, these observations may be explained on the basis of trace impurities. It is evident that small amounts of relatively inert impurities in a mineral which acquires a high activity would pass unnoticed. For instance, iron, a common impurity which is almost unaffected by neutron bombardment, would have to be present in amounts greater than 30% in a mineral of copper or manganese before any lowering of activity would have been noticed in this experiment. On the other hand, 0.01% silver in galena would raise the counting rate 200-fold over the calculated activity for galena.

Two noticeable exceptions to these generalizations are the cases of mercury and calcium minerals. Cinnabar, the only mercury-bearing mineral studied, has an experimental activity considerably lower than the estimated value. This is probably due not to a large percentage of impurities, but to the fact that Hg has very weak gamma radiation which is difficult to detect. The minerals for which calcium contributes the major portion of the activity are exceptional in that their experimental activities deviate considerably from the estimated values even though these values are relatively high. This, in part at least, may be due to the lack of definite information on the radioactive isotopes of calcium. Therefore the estimated activities rather than the experimental activities may be in considerable error.

Application to Mineral Differentiation

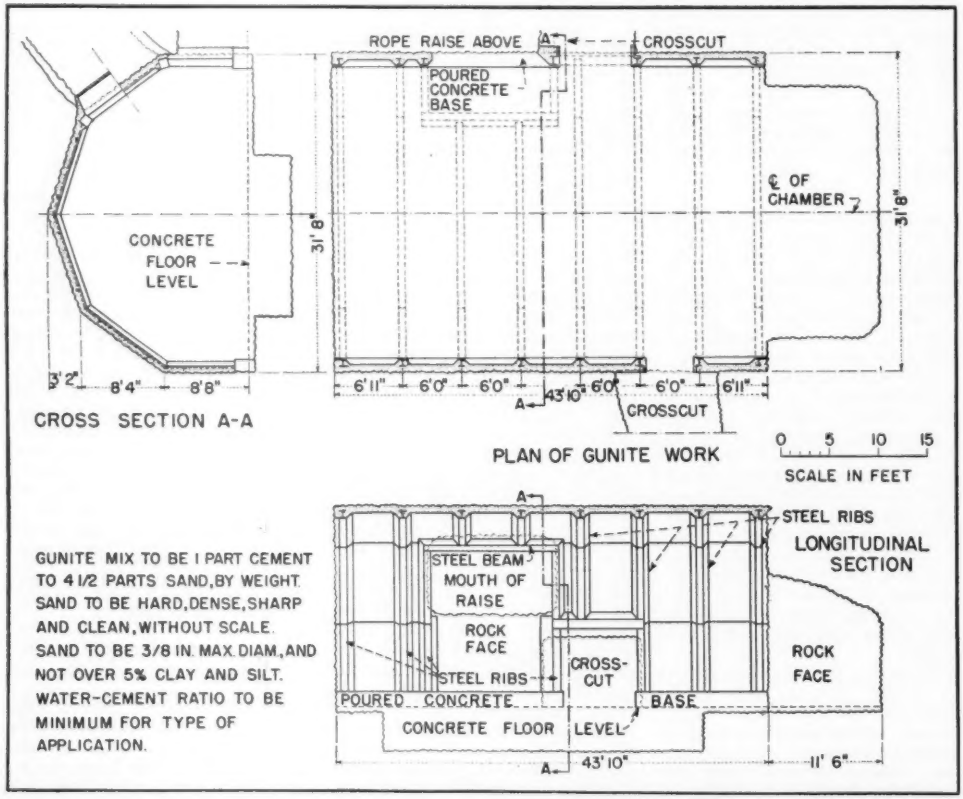
The practicality of mineral separation based on induced radioactivity can be evaluated from our measurements. Table I and the cut on p. 97 suggest such a process is

(Continued on page 174)



FOR PLACING REINFORCED CONCRETE LINING used to support hoist-room excavation, a wooden bin for storing aggregates was built in square sets, and sand and gravel were delivered to it in mine car, shown here, which was hoisted through sets to top of bin on third floor.

MINE CAR LOADED WITH AGGREGATES coming through trap door in third floor of square-set timbered excavations. Door has been withdrawn by air-cylinder to permit this. Air line to cylinder is seen at right of workman. Note tugger rope at left for scraper in bin.



CONCRETE AND STEEL support excavation for New Park's underground hoist room. General arrangement is shown.

DUMPING MINE CAR loaded with aggregates into wooden storage bin built into square-set timbers after hoisting it to third floor. Note scraper in bin in foreground and rope running to tugger hoist which handles both scraper and mine car. Scraper aids discharge through bin.

AGGREGATE IS BEING DRAWN from wooden storage bin into feed hopper of 6-cu. ft. concrete mixer. Bin, which is equipped with steel wing discharge gate in center, will hold content of 40 mine cars. Concrete, when mixed, is fed by gravity to placement gun.

Mechanical Handling Aids Building Of New Underground Hoist Room

Fractured ground gives difficulties in excavating and support, requiring use of steel and concrete in constricted area.

JOHN B. HUTTL
Associate Editor
San Francisco, Calif.

SUCCESSFUL EXCAVATION in difficult ground and use of mechanized materials-handling methods in a relatively constricted area, to save labor in the subsequent concreting and guniting, has marked the construction of New Park Mining Co.'s underground hoist room at its recently deepened Mayflower shaft at Keetley, Utah. The project, now nearing completion at the three-compartment shaft, was undertaken as part of a program to improve underground working conditions preparatory to increasing production and developing new orebodies at greater depth. When it is finished, mining will be possible on additional levels below the present 1500-ft. horizon.

The hoist itself is a double-drum Nordberg driven by a 350-hp. motor. Its capacity is 21,500 lb. down to 3,000 ft.; its rope speed is 1,000 fpm. The 6-ft. drums are helically grooved for 1¼-in. rope. The old hoist which it will replace has a rope speed of 500 fpm and a maximum rope pull of 10,000 lb. After removal it is to be changed into a single-drum hoist for auxiliary work in the shaft's manway compartment.

The new hoist is housed in a chamber about 44 ft. long, 30½ ft. wide, and 19½ ft. high, inside the concrete lining. The electrical power and control equipment stands in the gunited extension at the west end of the chamber, as shown in the drawing.

Choice of selecting an appropriate site for the new hoist room was rather limited owing to the grouping of equipment installations and materials storage facilities around the shaft station. After careful study it was decided to excavate the chamber south of the old hoist installation. Preliminary work consisted of determining the nature of the ground at the proposed site by diamond drilling and extending the crosscut which terminated near the old hoist to the site selected. The diamond-drill work revealed the existence of a diorite and altered limestone just beyond the western limits of the new chamber. This called for transferring the hoist motor originally on the west end of the hoist foundation plate to the east end, to avoid extending the west end of the chamber into this altered and loose formation.

Broken Ground Causes Change of Plans

Upon entering the actual area of the chamber site, large open fractures striking northwest across the proposed chamber were found to exist. These were 4 to 6 ft. apart, making large, loose diorite blocks

requiring heavy support. Further work showed that, to take care of the blocky nature of the rock and the large run-off of spring water, it would be necessary to abandon the original plan of installing heavy steel sets or arches for supporting the ground and the crane assembly (for erecting the hoist) and merely guniting the walls, in favor of using reinforced concrete lining behind the steel sets to the ground line.

Primary excavation work included cutting out the hoist chamber roughly 32 ft. wide, 60 ft. long, and 21 ft. high, raising the three-compartment shaft 45 ft., and driving a new rope raise 14 ft. wide and about 10 ft. high from the new hoist chamber to the sheave installation, a distance of 190 ft. The rope raise is designed to provide ample rope clearance at all points without excessive opening of ground. For instance, it is wider at the drum end and narrower at the sheave end, and there is a sag of about 3½ ft. in the center, giving the raise a sort of catenary form. From the junction with the chamber up, it is concrete-lined for 30 ft., followed by steel sets wherever necessary. The sheave wheels proper are mounted on steel I-beams on top of the concrete foundation.

Excavation by Square-Setting

The hoist chamber was excavated by square-set stoping. On the first or lowest cut 7-ft. sets were used, and 6-ft. sets on the following two cuts. After mining out the core in this manner, a concrete wall was poured around the chamber to serve as foundation for the steel sets or arches. These were subsequently installed at 6-ft. centers. The sets are made from 8-in. I-beams. These steel sets were blocked to the rock with steel and the square-set timbers were then blocked to the steel

To reduce water seepage from the roof area, long diamond-drill holes were drilled up from the crosscut extending some distance beyond the chamber at angles varying from 45 to 50 deg.

Installation of steel sets was followed by placing the wooden forms required for pouring the concrete lining. This was done in a unique and simple manner. The steel sets were used as framework and support for the form lumber which consisted of 2x12-in. boards with a slight bevel at each end. These were wedged securely between the flanges of the I-beams, followed by attachment of a wooden brace exactly in the center between two sets to give extra stability to the entire form assembly. Concrete lining operations were materially speeded up by use of this form-placing method.

Equipment used for pumping concrete in place consisted of a 6-cu. ft. concrete mixer, and an air-operated concrete placement gun with 6-in. o.d. pipe. The mixer was installed in a manner that would permit feeding the mixed material to the placement gun by gravity.

Aggregates Handled in a Constricted Area

The procedure for handling aggregates with a minimum of hand labor in a very constricted area was as follows: The sand and gravel delivered to the mine portal were premixed in desired proportion here, and the mixed material hauled in 22-cu. ft. mine cars to the entrance of the new hoist chamber. Here, each car was hoisted to the third floor of the square sets through an air-operated trap door installed on this floor, and dumped into a wooden storage bin built into the square sets after closing the trap door. A track running along the bin facilitated dumping at any point, thereby distributing the material evenly. The bin, rectangular and equipped with a steel wing discharge gate in the center, was large enough to hold the contents of 40 mine cars. Material in the bin was moved to the center by a two-way scraper operated by a small tugger hoist at the west end. Close by was the hoist that handled the mine car mentioned.

From the bin the mixed aggregate was discharged through the wing gate direct into the feed hopper of the concrete mixer. From this the concrete went by gravity to the placement gun used to blow it into the space between the forms and the rock which contained the steel reinforcing grids. Concrete which consisted of a 1:2:4 mix was used.

Save for the gun, the same equipment setup was used for placing the concrete foundations of the sheave installation and for guniting the rock in the room that housed the electrical power and hoist control equipment, as well as sections of the rope raise. Concrete from the mixer was elevated to the sheave installation in a small skip operating on an incline track. This was also used to transfer mixed cement for gunite work to a small feed bin directly above the cement gun itself. The gunite mixture consisted of four parts of sand and one part of cement.

To facilitate pouring the hoist foundations, the mixer and wing gate in the center of the bin floor were moved to the east end of the elevated bin used for storing the aggregates. Mixing operations followed previous practice except that the mixed concrete was transported to the foundation forms on wheelbarrows. The hoist chamber floor was poured after removing the square sets and placing the forms used for making the conduits for power cables and drainage. All chamber walls were then painted with Aquella to seal the concrete lining and gunite against water seepage. Installation of the equipment then followed.

E&MJ expresses thanks to W. H. H. Cranmer, president and general manager, New Park Mining Co., for permission to publish the foregoing article; also to Clark L. Wilson, superintendent, and to F. A. Kuhlman, mine engineer, for assistance in gathering the information presented.

The Truck's Important Role in Open Pit Haulage

TRUCK OPERATION AT 10 western mines was dealt with by H. Carroll Weed, general superintendent, Inspiration Consolidated Copper Co., Inspiration, Ariz., in a paper presented at the recent meeting of the American Mining Congress in Denver. At seven of these mines, trucks are the sole means of transportation. At the remaining three, trucks are used as an auxiliary to railroad haulage.

Trucking in Minnesota in 1951, according to C. A. Lindberg, of U. S. Steel's Oliver Iron Mining Division, required more than 1400 truck units to move 77.5% of the 231-million tons of iron ore and stripping handled that year. Truck size trends to the 35-ton unit, with about 400 hp. in one or two diesel engines and in straight end-dump trucks having tandem rear axles. Three experimental 50-ton trucks are under test. Two of these have 550 hp. of butane power and one 600 hp. of diesel power.

How PROSPEROUS Is The USA?

Just how prosperous *are* the people of the United States?

The sole purpose of this message is to help clear up the confusion and controversy that surrounds this important question.

To find out how much prosperity, or material well-being, the people of the United States now enjoy, it is necessary to get answers to these questions:

1. As compared with other times, what is the total amount of goods and services that we have available for our enjoyment?

2. How great, on the average, is the share of each American in this prosperity?

3. How does our prosperity compare with that of other nations?

National Product at Peak

The government statisticians who do the bookkeeping for the nation produce a figure called the Gross National Product. It is supposed to be the total obtained when you multiply the amounts of everything we produce by the prices of everything produced. This year the GNP, as it is commonly tagged, will add up to something like $345 billion.

Since this will be the highest total that GNP has ever attained, some people will acclaim it as evidence that we now are enjoying the greatest prosperity on record.

The GNP, however, is not an accurate yardstick of prosperity. It may go up because of price inflation alone without any increase at all in the output of goods and services. Also the GNP includes very large amounts of goods and services, such as those for the military, which are in fact a result of misfortune rather than of a condition that might properly be called prosperity. Moreover, there is no deduction from the GNP to make allowance for the equipment that is worn out in producing it.

Little Recent Progress

When we make adjustments such as these—to find out how much of our production really is available for the use and enjoyment of the civilian population—the *adjusted* national product since the beginning of World War II comes out about as follows. The effects of price inflation have been removed from these figures.

YEAR	ADJUSTED NATIONAL PRODUCT	
	Billions 1951 Dollars	Index (1946 = 100)
1940	$176.2	76
1946	232.5	100
1947	240.7	104
1948	244.3	105
1949	239.7	103
1950	260.9	112
1951	267.9	115
1952	264.3	114

From this table the fact stands out that progress in raising our level of prosperity has been halting. What progress we have made came in a few dramatic increases before or after a military build-up. Aside from those, the progress has been fairly slow. This year, 1952, it has been particularly discouraging.

Again, when account is taken of the number of people who must share in the goods and services that are available, our progress is even less marked. This is shown by the following table which gives the share of the average American in the national product. This, as the table indicates, is arrived at simply by dividing the total of available goods and services by the population on hand to share in them.

YEAR	POPULATION Millions	ADJUSTED NATIONAL PRODUCT Billions 1951 Dollars	ADJUSTED NATIONAL PRODUCT Per Person
1940	132.0	$176.2	$1,335
1946	141.3	232.5	1,645
1947	144.0	240.7	1,672
1948	146.6	244.3	1,666
1949	149.2	239.7	1,607
1950	150.6	260.9	1,732
1951	154.4	267.9	1,735
1952	156.9	264.3	1,685

Here it is clear that we have made little or no headway since the end of World War II.

U.S. Compared to Other Nations

Although we are making slow progress in increasing our prosperity, as measured during recent years by the amount of goods per person, we still are by long odds the most prosperous people on earth. This can be seen from the following table. It offers a rough measure of how the adjusted output of goods and services per person in the United States compared in 1951 with that in a number of other countries:

COUNTRY	PER PERSON
United States	$1,735
Canada	1,231
United Kingdom	614
France	510

To figure more closely "How Prosperous is the U.S.A.?" we must answer a number of other questions. One of the most important will be the subject of a later editorial in this series. It is "Who Gets What?" How have various income classes and occupational groups shared the total available goods?

Another question that has a basic bearing on the quality and durability of our prosperity is "How fast are we using up irreplaceable natural resources, such as oil, iron ore, and copper, to sustain it?" Any attempt to deal with this very complicated question must also be deferred.

A Problem for the Future

In the meantime, however, key facts about our prosperity are that:

1. Most of the increase in the nation's total production in recent years has been to meet military requirements rather than to improve the American standard of living.

2. The increase in the supply of goods and services actually available for the average American has been slow and halting.

3. We Americans are still extremely well provided with the good material things of life, as compared with peoples in other lands.

These three facts bring to mind a whole series of policy questions. What can be done to speed up progress in improving our prosperity? What—to repeat the question discussed in the previous editorial in this series—can be done to make our prosperity less precarious?

Here, however, the purpose is not to prescribe. It is simply to indicate as accurately as it can be done in a brief article the actual state of the nation's prosperity.

In doing this much, it can properly be remarked that the record presents to the American economy both a problem and an opportunity of surpassing importance. It is that of building a prosperity that will be both more progressive and more secure than any we have known in recent years. In the light of what clearly remains to be done, we shall make a grave mistake if we use up any of our energy in congratulating ourselves on the relatively meager progress here recorded.

McGraw-Hill Publishing Company, Inc.

PROBLEM — *To make a 200 mesh separation on a high-solids content iron ore . . . without prior dilution.*

RESULT — *Extensive test work on a 24" dia. DorrClone resulting in an order for six additional 24" units.*

At Cleveland Cliffs Iron Company's Canisteo Washer, a 24" dia. DorrClone was installed on a test basis to determine the desirability of desliming their classifier overflow prior to conventional fine ore treatment. Standard hydroseparation was impossible without considerable dilution as these overflows contained a high percentage of solids.

The DorrClone was required to make a satisfactory size separation on feeds varying widely in both percent solids and structure. During the tests, solids varied from 17-35% and +200 mesh in feed varied from 25-35%. The Beneficiation Engineer at Canisteo reported that "after initial adjustments, these variations seemed to have little effect on the operation . . . the DorrClone operated very satisfactorily."

If you have a desliming problem, there's a good chance that the DorrClone, with its high capacity-for-size and ability to handle flocculant or heavy pulps, will be the solution. For further information write for bulletin No. 2500. The Dorr Company, Stamford, Conn.

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MARKETS—Trends and Prices *(Continued from page 69)*

Summary of Copper Statistics

Following is a summary of the most recent copper statistics of Copper Institute, embracing most of the free world's operations in the metal, figures in short tons:

UNITED STATES

Production:	Aug.	Sept.	Jan.-Sept. 1951	Jan.-Sept. 1952
Crude, primary	(a)75,457	78,691	715,095	720,273
Crude, secondary	3,911	3,177	48,194	36,559
	79,368	81,868	763,289	756,832
Refined	95,366	98,930	893,240	869,302
Deliveries, refined	(a)127,106	(b)134,689	999,028	(b)1,035,957
Stocks, refined	83,771	(c)71,456	62,093	71,456

OUTSIDE UNITED STATES

Production:	Aug.	Sept.	Jan.-Sept. 1951	Jan.-Sept. 1952
Crude, primary	(a)112,865	124,475	1,023,308	1,059,212
Crude, secondary	549	986	3,977	5,124
	113,414	125,461	1,027,285	1,064,336
Refined	(a)98,682	96,511	896,871	918,123
Deliveries, refined	(a)73,695	83,784	722,378	763,399
Stocks, refined	(a)167,331	157,450	163,538	157,450

(a) Corrected. (b) Includes tonnages delivered from government stocks. (c) Includes tonnages delivered to U.S. consumers at foreign ports.

Official London Prices

Consumers in the United Kingdom obtain copper, lead and zinc at prices named by the British Ministry of Materials. Delivered prices in effect as September ended were as follows:

COPPER:	Per Long Ton £	s.	d.
Electrolytic, high conductivity	285	0	0
Fire refined, high conductivity	285	0	0
Fire refined, high grade	284	10	0
Fire refined, min. 99.7 percent	284	0	0
Fire refined, min. 99.2 percent	283	10	0

Lead: Trading in lead on the London Metal Exchange was resumed on Oct. 1, on which date fixed quotations by the British Ministry of Materials were discontinued.

ZINC:			
Foreign (G.o.b.) duty paid	110	0	0
Domestic (G.o.b.) duty paid	110	0	0
Prime Western and debased	110	0	0
Refined and electrolytic	114	0	0
Minimum 99.99 percent	116	0	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

October 31, 1952

Aluminum ingot, 99 plus percent, lb. (effective Aug. 4)	20c.
Antimony, spot, lb., 5 tons and up but less than carload, in cases	42.47c.
Bismuth, ton lots, lb.	$2.25
Cadmium, commercial sticks, delivered, lb.	$2.00
Calcium, lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.07
Cobalt, 97 to 99 percent, per lb.	$2.40
Germanium, lb.	$340.00
Indium, troy oz.	$2.25
Lithium, lb., 98 percent	$9.85 @ $11
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	56½c.
Magnesium, 99.8 percent, carloads, lb., producer's plant, Freeport, Texas	24½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$90.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$191 @ $193
Selenium, 99.5 percent, lb.	$3.00 @ $3.50
Silicon, minimum 97 percent, carloads, lb.	20c.
Tellurium, lb.	$1.75
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 99.3 percent, lb.	$5.00

(a) Includes U. S. duty.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per unit	$38.50 @ $42.50
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 44% Cr_2O_3 no ratio	$27.00 @ $28.00
48% Cr_2O_3 3 to 1 ratio	$44.00 @ $46.00
Iron Ore, Lake Superior, Lower Lake ports, long ton: Old Range bessemer	$9.45
Mesabi bessemer	$9.20
Mesabi, non-bessemer	$9.05
Lead (Galena), 80 percent, Joplin, Mo., ton	$166.50
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, $1.20 @ $1.22 c.i.f. U.S. ports, duty extra. Long-term contract nominal at 90c. to 93c., c.i.f. duty extra.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	60c.
Tantalite, 60% concentrate, per lb.	$2.00 @ $2.55
Tungsten Ore, per unit of WO_3 Foreign, 60 percent, f.o.b. foreign ports	$52.00 @ $54.00
Domestic, scheelite, 60 percent f.o.b. mill	$65.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	31c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$90.00

(a) F.o.b. port of shipment.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	5½c.
Cobalt Oxide, 72½% to 73½%, ceramic grade, per lb.	$1.82 @ $1.84½
Copper Sulphate, 100 lb.	$8.95 @ $9.95
Germanium Oxide, lb.	$142.00

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of alloy, 5 lb. ingot	$1.56
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	21¾c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$ 225
Ferromolybdenum, 55 to 65 percent Mo. lb. of Mo. contained	$1.32
Ferrosilicon, 50 percent, per lb. of contained Si	12.4c
Ferrotungsten, 75 to 80 percent, lb. of W contained	$4.85
Ferrovanadium, per lb. of V delivered	$3.00 @ $3.25
Silicomanganese, Max. 1½ percent carbon, per lb. contracts	9.9c.
Spiegeleisen, per long ton. 19 @ 21 percent grade	$85.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds) ton: Crude No. 1	$960 @ $1,500
Crude No. 2	$595 @ $900
Spinning fibers	$320 @ $515
Shingle fibers	$150 @ $200
Paper stock	$109 @ $137
Waste	$77
Shorts	$35 @ $70
Asbestos, Vermont, f.o.b. Hyde Park: Spinning fibers	$279.50 @ $302.00
Shingle stock	$135.00 @ $162.00
Paper stock	$81.50 @ $115.00
Waste, stucco or plaster	$71.40
Refuse or shorts	$34.00 @ $63.00
Barytes, f.o.b. mines: Georgia, crude, per long ton	$13.00 @ $13.50
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$10.15 @ $10.40
Bauxite, long ton, f.o.b. point of shipment: Domestic, crude, 50 to 52 percent (not dried)	(a) $4.50 @ $5.50
Domestic, chemical, 55to 58 percent	(a) $8.50 @ $9.50
Domestic, abrasive, 80 to 84 percent	(a) $18.00 @ $18.50
China Clay, f.o.b. mines, ton: Georgia, filler and ceramic grades	$8.50 @ $9.50
North Carolina ceramic grade	$20.25 @ $22.25
Feldspar, bulk ton: Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @ $22.25
Glass feldspar, white, 20 mesh	$11.75 @ $12.50
Flourspar, f.o.b. mines, bulk, 70% effective ton	$43.00
60% effective CaF_2	$40.00
Acid 97% concentrate, bulk, ton	$60.00
Fuller's earth., f.o.b. Georgia or Flordia, ton	$7.00 @ $14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$36.30
Mica—Domestic, f.o.b. mines. Punch 12 to 22c. per lb. according to size and quality. Sheet clear, 1½ x 2 inch, 80 to 85c.; 2 x 2 inch, $1 10 to $1.20; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch, $1.80 @ $1.90; 3 x 4 inch, $2.20; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet, ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton Scrap $32 and up.	
Ocher, Georgia, ton, in sacks	$26.25
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	Not quoted
Sulphur, Texas, mines, long ton	$22.00
Talc, f.o.b. works, ton: New York, purified	$18.50 @ $20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton: 40 mesh, cream colored	$30.00

(a) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces	$54.50
Steel, f.o.b., Pittsburgh billets, net ton	$59.00
Structural shapes, 100 lb.	$3.85

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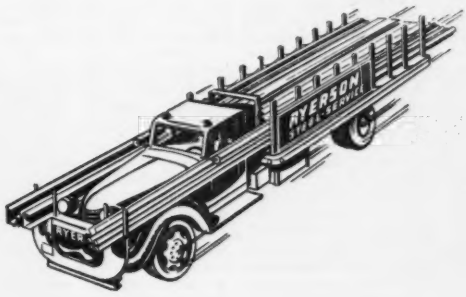

STEEL

Carbon, alloy, stainless—every kind of steel is on hand. Though some sizes are still occasionally out of stock, most requirements are usually available.

SERVICE

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PRINCIPAL PRODUCTS

CARBON STEEL BARS—Hot rolled and cold finished
STRUCTURALS—Channels, angles, beams, etc.
PLATES—Many types, including Inland 4-Way Safety Plate
SHEETS — Hot and cold rolled, many types and coatings
TUBING — Seamless and welded, mechanical and boiler tubes
ALLOYS — Hot rolled, cold finished, heat treated. Also tool steel
STAINLESS — Allegheny bars, plates, sheets, tubes, etc.
BABBITT—Five types, also Ryertex plastic bearings
MACHINERY & TOOLS—For metal fabrication

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WASHINGTON IMPACT

Morton A. Reichek, McGraw-Hill Washington News Bureau

- **Government May Treat Alloy Metal Ores**
- **Aluminum, Titanium Expansion Goal Raised**
- **Specific Aid Set For Small Mines**

THE DEFENSE MOBILIZERS made a lot of noise about alloying metals last month. At least most everyone thought high-temperature alloys were the subject of the tempest. The government referred mysteriously to unnamed "critical Band 1 materials."

Henry H. Fowler, director of the Office of Defense Mobilization, told the Joint Congressional Committee on Defense Production that in case of war, critical shortages of the high-heat alloys, needed in jet aircraft engines, would "constitute harmful ceilings in the striking and defense power of the U. S., which would take some years to overcome, unless provided for in advance." He hammered away again at this theme in ODM's quarterly report to the president.

This was all a prelude to ODM order 22, issued Oct. 17 with a great deal of fanfare, including a Fowler appearance on television. Purpose of the order: "To reaffirm the policy, assign responsibility and specify the further actions necessary to minimize the prospective full mobilization shortages of certain strategic materials specified as Band 1."

Specific effect of the order: Nothing new. Observers interpreted it as a needling job on the Defense Materials Procurement Agency, and as a possible green light for more liberal contracts on cobalt, columbium, molybdenum, nickel, tantalum, and beryllium or tungsten.

DMPA was also instructed to recommend: (1) whether it would be more economical for the government to build its own facilities for these materials than to buy the metals from private producers; and (2) changes in tax and defense legislation. There's no legislative authority for the government to build plants now. On the tax side, DMPA will recommend that all expenses in mining exploration be made deductible.

Aluminum Expansion

Light metal development was given a powerful booster shot last month, when the Defense Production Administration increased the aluminum expansion goal from 1.5-million tons a year by 1954 to 1.7-million tons, and titanium from 10,000 tons by 1955 to 22,000 tons. Both goals were hiked to meet revised military requirements.

This was the third upward revision in the aluminum expansion program since pre-Korea. U.S. aluminum ingot output totaled 718,622 tons in 1950; 836,881 tons in 1951; and will reach an estimated 1-million tons this year.

The formal announcement is just a starting point for negotiations. The additional expansion is supposed to be made by "new domestic producers, so far as possible," DPA has said. The usual incentives are offered: fast tax write-offs on new plant and equipment, and market guarantees.

Last April, DPA made a similar invitation to companies interested in starting aluminum ingot operations. At that time, the proposed new expansion was for 140,000 tons a year. But DPA was unable to work out any deals. Potential new producers balked at the infeasibility of making aluminum at existing price ceilings; they bluntly wanted subsidies. GSA-DMPA Administrator Jess Larson, who also enters the picture, opposed a two-price system in aluminum, however.

Kennecott Copper, Olin Industries, and Spartan Aircraft reportedly expressed interest in starting aluminum production. These companies are presumably participating again in new government negotiations.

Alcoa's much-heralded Taiya project in Alaska doesn't figure in the third round of aluminum expansion. It couldn't possibly start production before 1957. Under the new program, aluminum shipments are supposed to start flowing to the stockpile in 18 months.

There have been no firm proposals made so far for participation by potential new producers. And since the Munitions Board's increased aluminum requirements have to be met hurriedly, new negotiations with the Aluminium Company of Canada are a real possibility.

Correction

The figure for reserves of manganese ore in the State of Maine was mistakenly given on this page of our issue of August, 1952, as 275,000 tons. This reserve figure should have been 275-million tons.

Titanium Expansion

Titanium is now at the same stage as aluminum at the turn of the century. But DPA's increased goal of 22,000 tons annual output in 1955 should push titanium development as far in five years as aluminum went in 50 years.

The Munitions Board recommended an increase to 35,000 tons a year. This would have required $140-million for new plant and equipment and about $525-million to buy the metal. Although anxious to boost titanium, DPA didn't want to tie up that kind of money in the high-cost metal at this time. The agency has hopes that production costs will eventually be greatly reduced.

The new goal will serve as a bigger target for DMPA, which already has contracts with Titanium Metals Corp. (jointly-owned subsidiary of National Lead and Allegheny Ludlum Steel) and the DuPont Co., supporting an annual output of 7,200 tons in 1954.

The tonnages talked about for titanium are still peanuts, of course, when compared to other metals. To date, investment in equipment for titanium totals about $30-million. Another $67-million will be required to meet the new goal, it's roughly estimated. By comparison, the aluminum industry spent about $1½-billion in new plant and equipment during the past 10 years.

The standard expansion stimulants are offered by the government for titanium, plus a big extra. DMPA agrees to cancel out indebtedness in case the Kroll magnesium reduction equipment becomes obsolete during the life of the contract with the titanium producer.

DMPA is negotiating with at least two other titanium producers, now only in pilot-plant operation, to go into commercial-scale production. They are presumably among these prominent companies: Kennecott Copper, Crane Co., Union Carbide and Carbon, Rem-Cru Titanium, Dow Chemical, Kaiser Aluminum, Glidden Co., Monsanto Chemical, Horizons Titanium, Mallory-Sharon.

MSA Programs

The basic aim of the Marshall Plan has been to beef up the economies of friendly nations with money to buy essential commodities in dollar-area countries. Since the Marshall Plan's start in April 1948, grants totaling $1.08-billion have been made to European and Far Eastern nations for purchases of nonferrous metals and products, metallic ores and concentrates, and nonmetallic minerals.

Procurement authorizations for iron

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT Calol Vistac Oil

UNIT Rock drill-Ingersoll-Rand drifter

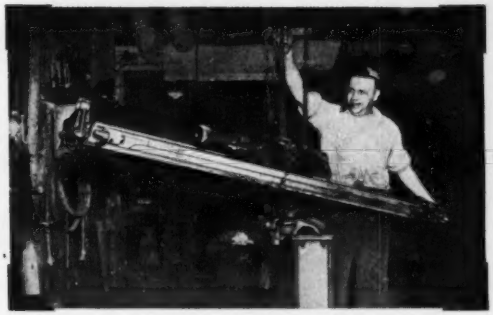
LUBRICATOR Line oiler

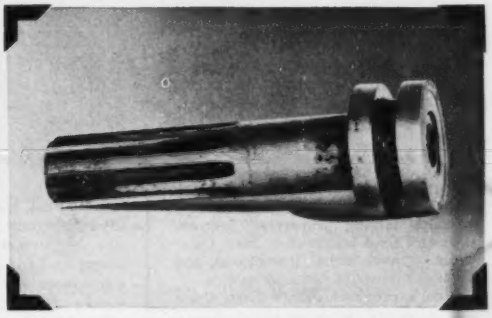
OPERATION Deep underground mining

CONDITIONS High humidity & temp.

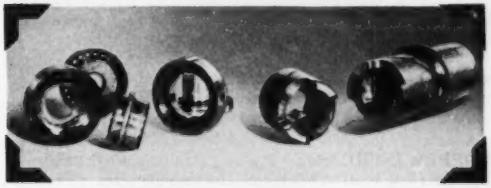
FIRM Sunshine Mining Co., Kellogg, Idaho

Only 0.001 wear on rock-drill piston in 120 shifts!





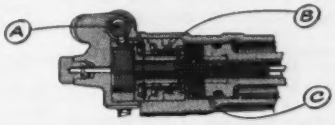
ON THE 3100-FOOT LEVEL of the famous Sunshine silver mine, this drifter, lubricated with Calol Vistac Oil, was in steady service for more than two months before coming in for service. When disassembled by "Drill Doctor" Dave Farnsworth, the piston "miked" only 0.001 inch wear despite the tough conditions in which the drill works. Working face is 400 feet below sea-level. Humidity is around 90 with atmosphere at a constant 75°F. After cleaning, the piston and other parts were put back in service.



VALVE-CHEST ASSEMBLY, chuck and chuck jaw from the drifter. Note the absence of lacquer or corrosion on air-valve parts. Because Calol Vistac Oil has held air-tool wear to the minimum and is approved by the miners, Sunshine Mining Co. has used it for more than 10 years.

REMARKS: Besides providing good air-tool lubrication without excessive vapor or bad odor, Calol Vistac Oil is excellent for heavy-duty plain bearings, reduction gears, motor gear heads, etc. It comes in several grades and may be applied by wick-, ring-, and drip-feed oilers.

How CALOL Vistac Oil cuts costs in air-tool equipment



A. Atomizes quickly and completely—carries evenly over all parts. Does not fog excessively and has no unpleasant odor.

B. Additives help form tenacious, oily, pressure-resistant film in wet or dry conditions—cuts wear and power loss. Small quantity lubricates efficiently.

C. Resists high temperatures and oxidation. Stays fluid at low temperatures.

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and steel mill products, including ferroalloys, total another $417.9-million. The grand total for all commodities: $11.6-billion.

Now the philosophy of the Marshall Plan has been broadened. The Mutual Security Agency, successor to the Economic Cooperation Administration, has begun what it calls "basic materials production and support projects" to pass on technical know-how to nations receiving U. S. military and financial aid.

The purpose is to boost output of critical raw materials in dependent overseas territories, specifically for European consumption. This will be done, primarily, by developing and improving transport and port facilities, power installations, and other auxiliary services vital to mining. A $19-million fund for fiscal 1953 has been established for Europe and Africa, and a $10-million one for the Far East.

This is the sort of thing MSA plans to do under the program: build up rail links from chrome, copper, and lead-zinc mines in Southern Rhodesia to seaports in Mozambique; construct ore-loading docks at Angola ports on the South Atlantic; construct hydroelectric projects in French Morocco to provide power needed to develop valuable mining properties; improve port and road facilities in New Caledonia to make nickel, manganese, and chromite deposits more accessible.

MSA's program differs from those of DMPA and the State Department's Technical Cooperation Administration (Point Four). DMPA's approach is short-range in nature and slanted toward U. S. requirements only. TCA operates in independent, underdeveloped countries outside the U. S. mutual security framework, and almost entirely in agricultural and related fields.

Coordinating the entire plan is Richard N. Johnson, assistant director of Mutual Security for resources and requirements. He ranks just below W. Averell Harriman. Johnson is a former New England textile manufacturer and newspaper publisher, and has held high positions in the War Production Board and the Export-Import Bank.

Aid to Small Mine Operators

The Small Defense Plants Administration, the special government agency created last year "to preserve and promote small-business enterprise," turned its attention to the mining industry last month for the first time.

SDPA formally set up "small business shares" in the government's iron ore and tungsten expansion programs. The purpose: to maintain the pre-Korea balance between large and small producers during the defense mobilization period.

Spelled out, this means that small producers will be helped to take up 24% of the iron ore expansion goal of 147-million tons in 1955. Small iron ore producers are defined by SDPA as companies with 800 employees or less. The expansion goal represents an increase of about 50-million tons in annual iron ore output since 1950. These tonnages are still to be covered by DMPA contracts under the program: 1953, 10.6-million tons; 1954, 11.1-million tons; 1955, 6-million tons.

In tungsten, the small producers' share is planned at 15% of the annual goal of 40-million lb. in 1954. The goal is an increase of 31-million lb. over the 1950 supply, which included both imports and domestic output. Only about 2% of DMPA's tungsten contracts have been made so far with small producers (75 employees or less). Ten million pounds are still open under the goal.

SDPA now plans to set up small business shares in the expansion goals for barite, chrysotile asbestos (strategic grades), beryl, and lithium.

Primarily, the agency's assistance takes the form of expediting applications for RFC loans and DPA rapid tax write-off certificates. Small mine operators can check with the closest of the agency's 13 regional offices for any other type of special government aid that might be desired. To date, SDPA assistance to the mining industry has been just about nil.

LABOR THIS MONTH

Joseph M. Gambatese, McGraw-Hill Washington News Bureau

McCARRAN WORRIES MINE-MILL LEADERS: Privately, Mine, Mill and Smelter Workers' leaders fear most the possibility that Senator McCarran might convince the new Congress that Communists and their sympathizers should be removed from union leadership. That's why they concentrated on the Congressional elections, paid little attention to either candidate for the presidency.

They can't understand, either, why mining management should be concerned about communism in Mine-Mill. One told us: "In recent years, the industry has had fewer strikes than ever by Mine-Mill."

From Denver come reports the McCarran investigation may cause a serious internal problem for Mine-Mill, perhaps another rank-and-file revolt. (See p. 126.)

NLRB ORDERS CARLSBAD ELECTIONS: Mine-Mill and the AFL International Association of Machinists will tangle in three bargaining polls the National Labor Relations Board has ordered at Carlsbad (N. M.) mines. Companies involved: International Minerals & Chemical Corp., Duval Sulphur & Potash Co. and U. S. Potash Co.

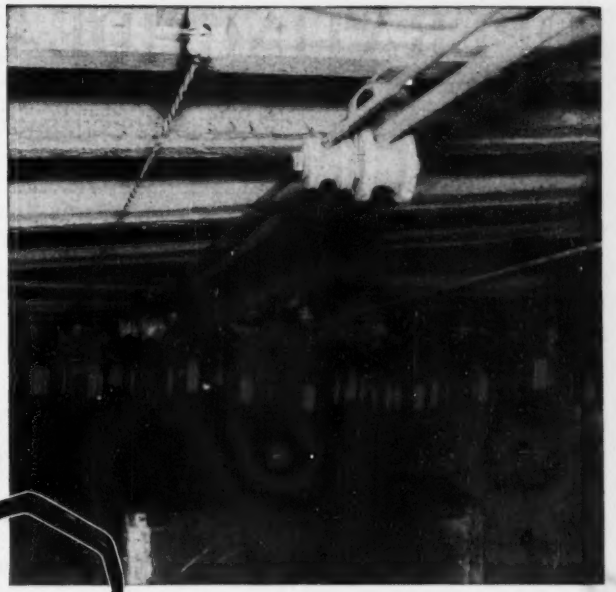
SUNSET MINERALS DISCHARGES HELD UNFAIR: Last year 20 employees of Sunset Minerals at Kellogg, Idaho, stayed home one day in a dispute over alleged hazardous conditions. Five were dismissed for not giving advance notice of absence, so other mine employees struck in protest against the discharges. After two weeks, the strike ended with company taking three of the five. Mine-Mill Local 18 then accused Sunset Minerals of unfairly discharging the other two for striking. NLRB agreed, ordered reinstatement with back pay.

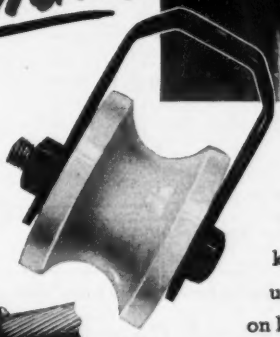
IT'S LEWIS VS. U. S. GOVERNMENT—AGAIN: The Wage Stabilization Board decided that John L. Lewis was not bigger than the law, cut 40¢ of the $1.90 daily pay increase in the United Mine Workers' new soft-coal contract.

This prompted another nation-wide coal strike and posed recurring question: How to get the coal miners back in the pits? A Taft-Hartley injunction failed to do the job last time, in 1950.

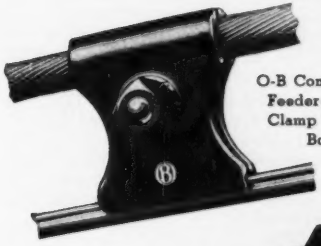
WSB CITES COPPER INCREASES: Main argument WSB used against Lewis was this: It couldn't let the coal miners get more than the increases in other industries. Even with the 40¢ cut, the coal miners' increases since January, 1950, base date of stabilization, adds up to 39¢ an hour (not counting the March, 1950, rise of 70¢ a day which really was for 1949). This, WSB said, just about matched the increases in copper and shipbuilding.

USE SAME FITTINGS FOR *Copper* AND *Aluminum* CABLE



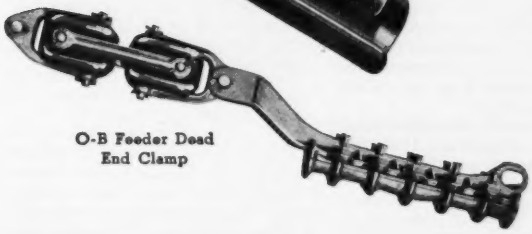


O-B Type-C Feeder Wire Insulator



O-B Combination Feeder-Trolley Clamp Without Boss

O-B Bulldog Feeder Sling



O-B Feeder Dead End Clamp

Adding aluminum cable to your feeder system is easy so far as hanging is concerned. You can keep on with your present feeder hanging method, using O-B Trolley and Feeder materials already on hand. Many of the O-B Feeder Cable fittings will hold the aluminum sizes you'll be using to carry your distribution system into new sections. Fittings can also be supplied for large (1,600,000 CM) aluminum cable.

A representative group of O-B fittings for copper or aluminum cable is shown here. You'll find others in the O-B No. 27 Catalog — and of course, your O-B representative can tell you many things about current feeder hanging methods. Let him help work out a system for your feeder circuit extensions!

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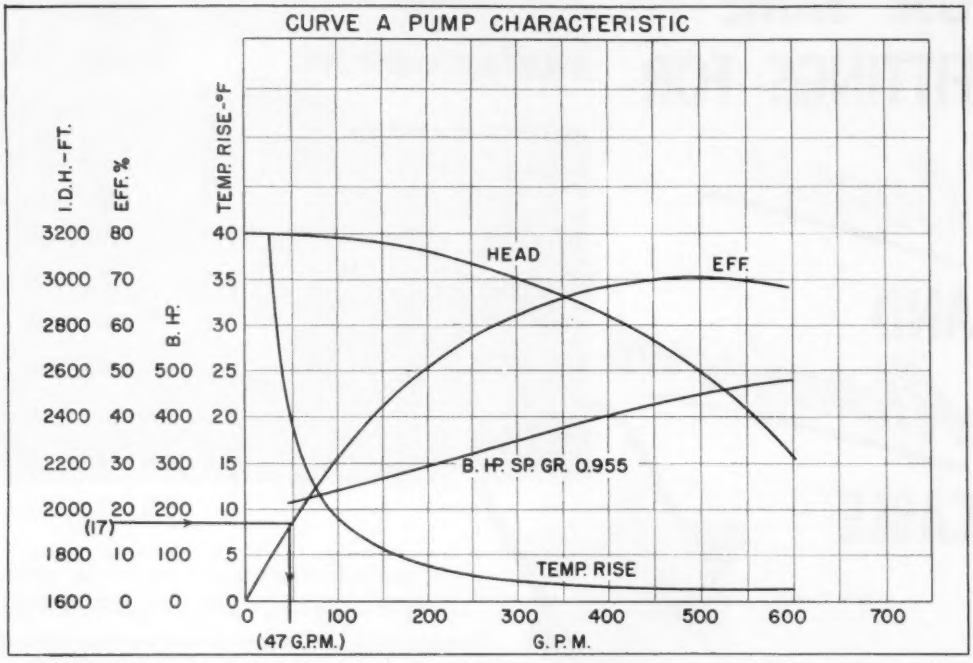
OPERATING IDEAS



CURVE "A" is used to determine minimum safe continuous flow of pump for a given efficiency. (See text.)

Minimum Continuous Flow of Centrifugal Pumps

E. C. CONDICT
Pump Engineer
De Laval Steam Turbine Co.

LIQUIDS IN A CENTRIFUGAL PUMP will flash into vapor when capacity being pumped is too low. Knowing when this will happen and how to prevent it means every operator can avoid this trouble.

Heat is generated whenever work is done. The work used by a pump to increase pressure of the liquid heats it up. When the capacity is large enough to carry off most of this heat, the temperature of the liquid passing through the pump will rise only a few degrees. The heat is not carried away fast enough at small flows, causing the temperature of the liquid to rise and flash into vapor.

The smallest flow at which a centrifugal pump can be safely operated is called the minimum **continuous safe flow.** If the pump is run continuously at less than this amount, the liquid will flash.

The amount the temperature of the fluid can rise before flashing is known as the allowable temperature rise. Suction conditions determine **NPSH (Net Positive Suction Head)** expressed in feet of the liquid being pumped measured at the centerline of the pump. NPSH is the net head above the vapor pressure corresponding to the temperature of the liquid handled.

The allowable temperature rise is found by converting the feet of available NPSH into PSI. Then add this PSI to the vapor pressure corresponding to the temperature of the liquid being pumped. This pressure is the vapor pressure corresponding to the temperature to which the liquid may be raised before it will flash.

Once the allowable temperature rise has been established, the minimum safe continuous flow can be calculated by the formula:

$$(a)\ n = \frac{TDH \times 100}{778\,t + TDH}$$

"N" is the pump efficiency expressed as a percentage, TDH the **total dynamic head** in feet, and "t" the allowable temperature rise expressed in deg. F. Capacity corresponding to this efficiency is found on the pump characteristic curves.

The next problem is to select the correct TDH. At no flow, the TDH is called **shut-off pressure** or **SOP.** The head of a normal centrifugal pump rises constantly to the SOP. Therefore, if the SOP of a pump is substituted for TDH in formula (a), any error in calculating the efficiency will be on the safe side. Substituting SOP for TDH in formula (a) gives:

$$(b)\ n = \frac{SOP \times 100}{778 \times t + SOP}$$

Curves B and B-1 were developed to eliminate calculations for centrifugal pumps handling hot water by solving the problem graphically. Similar curves may be made for any liquid. The temperature-rise

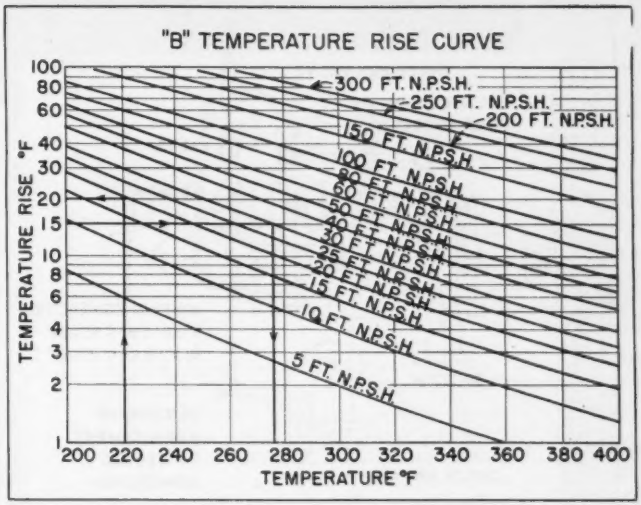
and pump-efficiency curves on the right side may be used for any liquid. Only the temperature rise curves on the left need be changed for other liquids.

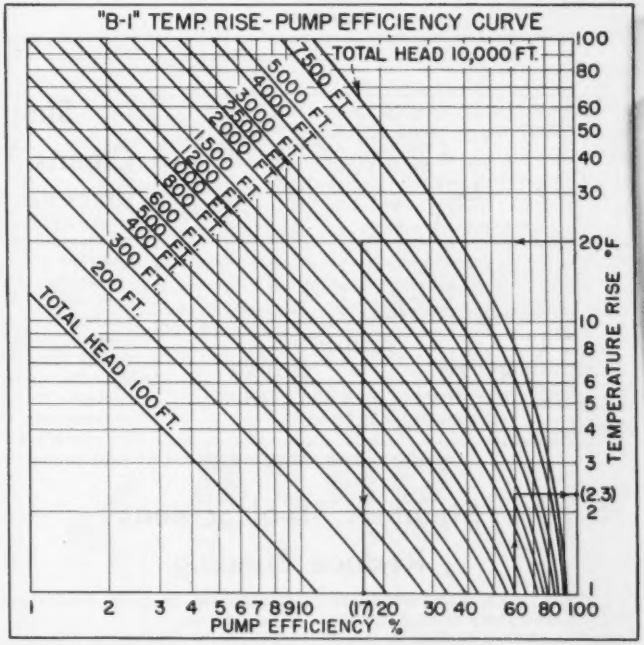
Let's for example take the pump whose characteristics are shown in curve "A." The SOP (shut-off pressure) is 3,200 ft. Determine the minimum continuous safe flow when handling 220 deg. F. water with 19 ft. NPSH. Curve "B" shows that the allowable temperature rise is 20 deg. F. Curve B-1 shows the efficiency corresponding to the minimum continuous safe flow is 17%. Curve "A" shows the capacity corresponding to 17% to be 47 gpm. Thus the minimum safe continuous flow for the pump whose characteristics are shown on curve "A" is 47 gpm.

How can the pump whose characteristics are shown be protected from flashing? Install a by-pass line having a suitable orifice from the discharge of the pump back to the suction heater. The size of the orifice is such that it will pass the minimum continuous safe flow. This by-pass line cannot go back to the suction of the pump, as the same fluid would be handled over and over again, causing the temperature to rise until the liquid would flash.

There are two fundamental ways of taking care of the by-pass flow. One way is to keep the by-pass open at all times. In this case the rated capacity of the pump must be rated capacity of the system plus the minimum continuous safe flow. The second method is to use some flow regulating device. When the pump capacity decreases and approaches the minimum continuous safe flow, a valve in the by-pass line is opened. When the flow is above the minimum the valve is closed. This may be done either manually or automatically.

Curves "B" and "B-1" may also be used to determine the NPSH required for a new installation. Let's assume that a pump is to be installed for handling 275 deg. F. water. It is desirable to have a 15 deg. F. allowable temperature rise. This gives a safe margin for possible surges in the suction heater. The temperature rise portion of curve "B" shows that 30 ft. NPSH will be required. This means that the heater must be placed high enough above the centerline of the pump so that after friction and entrance losses have been subtracted from the static elevation, there is available 30 ft. of liquid head over and above the vapor pressure.



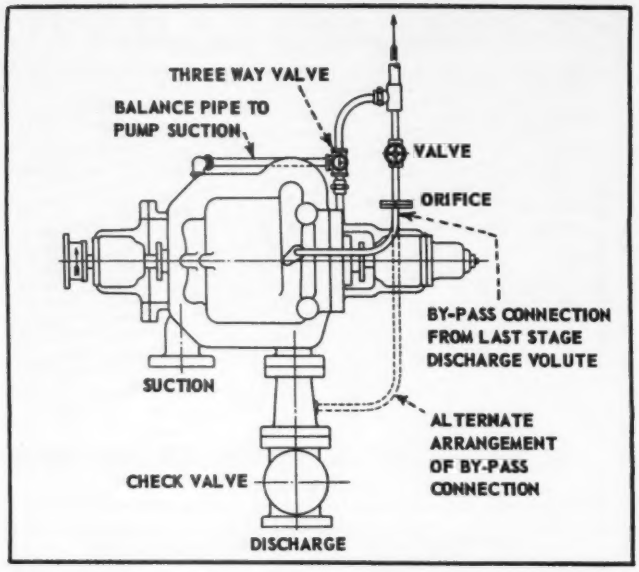


CURVES B AND B-1 simplify the method of determining the minimum safe flow for pumps and other corresponding factors. Lines on the graphs indicate solutions to problems cited in the text.

When liquids other than water are being handled it would be necessary to draw temperature rise curves based upon the characteristics of the liquid handled.

Temperature rise curves for a pump may be calculated by means of the temperature rise—pump efficiency curve "B-1" Take a given pump efficiency and from the characteristic curve select the corresponding head. For example, at 60% efficiency, the pump whose

(*Continued on page 112*)

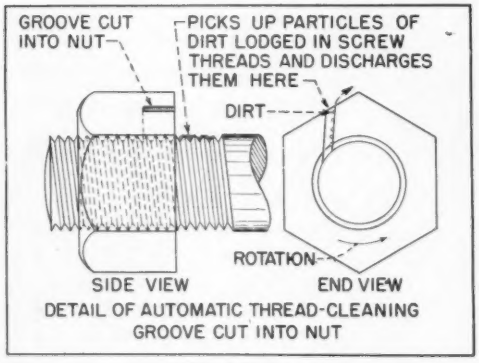


characteristics are shown on curve "A" has a TDH of 2800 ft. The corresponding temperature rise from curve "B" is 2.3 deg. F.

For mechanical reasons, such as unequal expansion of pump parts, it is desirable to limit the temperature rise. A maximum temperature rise not exceeding 30 deg. F. is a good practice. However, it is advisable to consult the pump manufacturer. Some materials cannot be operated above a certain temperature regardless of the allowable temperature rise.

Knowing when and how to protect a centrifugal pump from overheating is very important. Curves "B" and "B-1" or modifications suitable for the liquid being handled lets an operator know how to protect his pump from flashing.

TWO METHODS of installing by-pass systems to insure minimum safe flow for pumps.



DETAIL OF AUTOMATIC THREAD-CLEANING GROOVE CUT INTO NUT

Simple Groove in Nut Cleans Threads Automatically

SOMETIMES THE MOST SIMPLE ideas are the most ingenious. Here is one worked out by the mechanical staff of the Golden Cycle operations in Colorado several years ago. As in most underground operations, it is almost impossible to keep dirt and mud out of the threads of bolts of various types of underground equipment such as jackscrews for drill columns, side rods, hose couplings, pipe couplings, etc. If this dirt remains in the threads, it is ground into the space between the nut and the threaded surface. If, however, you cut one or more simple grooves into the nut or coupling, the grooves will act like a planer and remove the dirt particles.

Stainless Steel Screens Reduce Blinding

PROPER CARE and reconditioning of laboratory testing screens have long been a problem to which conscientious mineral processing engineers have given much thought. For meticulous metallurgical tests, L. A. Roe, of Bjorksten Research Laboratories, Madison, Wis., suggests the use of stainless-steel screens — particularly for those of finer than 150 mesh. Normally it is hard to decide whether a test sieve is too blinded to give reliable results. Theoretically there should be no blinding at all if extremely accurate results are to be obtained.

To assure acceptable accuracy, the Bjorksten Laboratories have adopted testing sieves fabricated entirely of stainless steel. These have been practical and much more economical than brass or phosphor-bronze types. Stainless steel cloth has long been available, but stainless steel frames usually have to be ordered specially from the manufacturer.

When a fine-mesh screen becomes badly blinded, it may be cleaned quite easily by alternate acid and caustic washings which will dissolve enough of the surface layer of most minerals to permit their easy removal from the sieve. Alternate washing with warm water, drying, and light tapping of the dry sieve aids in the process. Different minerals of course will require different solvents. In any event, care must be taken that the solution used does not harm the sieve cloth.

The all-stainless-steel sieves have a much longer life than conventional types, and their inherent vibrational characteristics result in least rapid blinding for most materials being subjected to a screen analysis.

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One mining company did. It wanted complete information—no gaps, nothing missed—for a big area. So we flew a huge net of criss-crossing lines for them, covering 900,000 acres with the airborne magnetometer. The search uncovered an important new magnetite find in an area explored by ground parties for 30 years and more!

That's why the airborne magnetometer is a key exploration tool in any mineral search today. The air survey works as a vast net, covering every part of an area. There are no omissions. Ground surveys follow rivers, streams, access roads. But the AERO mapper flies swiftly over jungle, muskeg, all sorts of terrain—and brings back a complete and detailed record. Moreover, AERO mapping costs far less than ground methods.

AERO, pioneer and leader in aerial magnetics, has flown over 400,000 miles with this tested exploration instrument. Our experience is worldwide. We have helped uncover new finds of magnetite, ilmenite and asbestos. Let our engineers meet with you.

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THE BLASTER

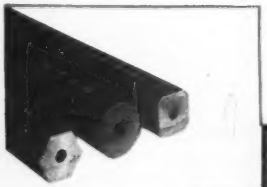
CRUCIBLE HOLLOW DRILL RODS

In rock-drilling operations, the blaster is a key man. He plans the blast, tells the drill-runners where to drill their holes, loads the charge for the greatest effectiveness.

He expects . . . and gets . . . peak efficiency from his men and the tools they use.

This is why Crucible Hollow Drill Rods rank first with crews supervised by top-notch blasters. Experience has shown them that Crucible rods stand the rapid-fire battering of modern rock-drilling longer; give them the least breakage, the greatest service life.

Crucible Hollow Drill Rods are right for the job because they are made by the world's largest producer of *tool and high speed steels.* From this metallurgical experience come the high mechanical properties that have set record after record for least cost per foot drilled. Use Crucible Hollow Drill Rods in all your drilling operations.



CRUCIBLE first name in special purpose steels

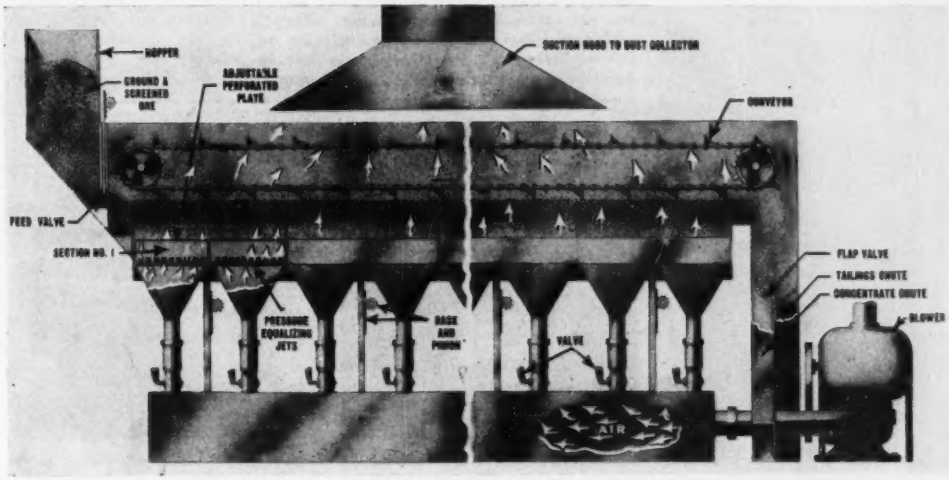
52 years of Fine steelmaking

HOLLOW DRILL RODS

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

FEATURE



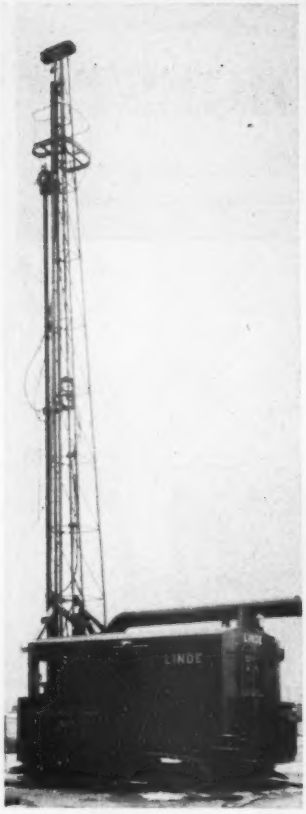
Dry Concentrator Offers High Recoveries

A 99% RECOVERY of gold, silver or lead from your ore is the claim of Dry-Ore-Concentrator, Inc., Redmond, Wash., for their new unit. Low first cost, lower power cost and minimum power requirement are added attractions. Ore need not be ground to a finer mesh than necessary for full release of mineral content. By varying the number of cells, capacity can be varied from 10 to 75 tons per day. For packing to remote points, the machine can be dissembled into parts, none of which weighs more than 150 lb.

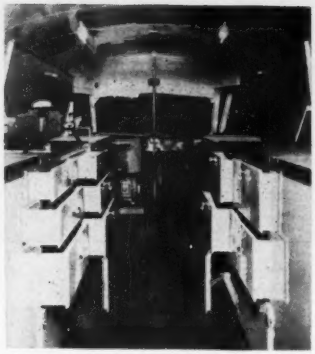
Dry, screened ore is fed by gravity from the hopper through the controlled feed valve into the conveying system over a blank area equal to the space between the blades of the conveyor chain. The ore is carried to the first of eight sections, each of which has four cells. (To show operating details, four central sections have been removed from the illustration above.) Compressed air, forced up through the perforated plate of the cells causes the ore to float on a continuous air suspension in an animated state. The metallic content of the ore is heavier than the gangue and falls into the cell. This process is repeated over the eight sections to remove a maximum of metallic material from the ore.

When sections become full of concentrates, the feed valve at the base of the hopper is closed to shut off the flow of fresh ore. The perforated plate bases are raised to a point level with the conveyor blades which carry off the concentrates over the same route used by the gangue. The flap valve, which during the separating operation had been open to the tailings chute, is now changed to close the tailings chute and opened to the concentrate chute. When the concentrates have been drawn off, the cell bases are lowered to the running position and the feed valve is opened, to resume separation on a continuous operating cycle.

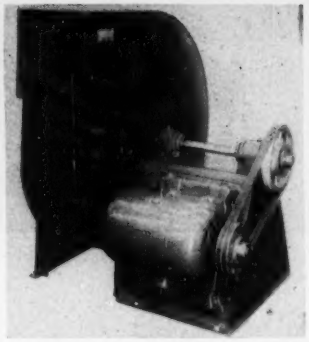
For further information about this dry ore concentrator, circle No. 1 on postage-free (if you live in U. S. or Canada) reply cards opposite page 118. Reply cards from other countries require stamps.



JET PIERCING MACHINE JPM-3, can now "drill" blast holes 7½ in. in diameter, 47 ft. deep. Blowpipe's descent is electronically controlled. Linde Air Products Co., New York, N. Y. (4)



MOBILE SAFETY STATION is equipped with every emergency and life-saving device that might be needed. One unit serves a camp. Mine Safety Appliance Co., Pittsburgh, Pa. (2)



FAN comes in 11 sizes with capacities from 670 to 44,000 cfm. Special blades for air, shavings, or other materials can be obtained from Westinghouse Sturtevant Div., Pittsburgh, Pa. (3)

SCHEELITE DETECTOR is lightweight, easy to handle. Throws ultraviolet light from underneath causing scheelite to fluoresce. John Harvey Instrument Co., Sydney, Australia. (5)

FLAW DETECTION INKS show flaws in ferrous alloys by electro-magnetic means; in nonferrous alloys by fluorescent methods. Manchester Oil Refinery, Ltd., Manchester, Eng. (6)

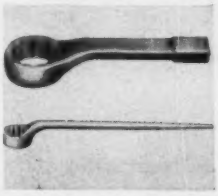
OFF-THE-ROAD TIRE floats through sand with only 20 to 25 psi pressure. Nylon in cord body enables tire to withstand flexing better, according to the manufacturer, B. F. Goodrich Co., Akron, Ohio. (7)

LOADER has a lifting capacity of 1,000 lb.; lifting height of nearly 11 ft. Mounted on a Ford tractor the loader uses separate hydraulic pump. Made by Dearborn Motors Corp., Birmingham, Mich. (8)

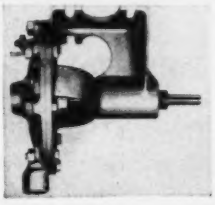
PLASTIC MASK with cotton gauze filter protects nose, lungs, face and eyes against nuisance dusts, chips and particles in all types of light, nontoxic work. Mask and shield cost $7.80 per dozen; extra filters, $2 per hundred. General Scientific Equiment Co. **(9)**

PUMP is gasoline-powered, lightweight (57 lb.) for portable fire-fighting work. Self-priming, it has a capacity of 15,000 gph and delivers water at pressures up to 100 psi. Effective in delivering fog, spray, stream or foam. McCulloch Motor Corp., Los Angeles, Calif. **(10)**

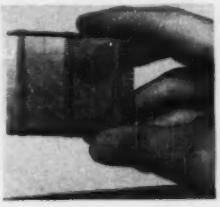
PLASTIC GASKET MATERIAL. Any slight leak which may occur after a vacuum line has been in service can be corrected without dismantling by applying 1/32 in. of Plastic Gasket material on outside surfaces where flange meets gasket. Flexrock Co., Philadelphia, Pa. **(11)**



WRENCHES of the Proto line, long slugging box and spud end box have been improved. (1) Handle has built-up striking face to receive blows; (2) joint of shank and box strengthened; (3) shank streamlined for better grip. Plomb Tool Co., Los Angeles, Calif. **(12)**

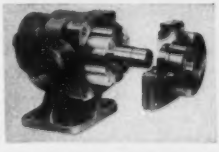


REVERSIBLE PUMP designed primarily for circulating cooling water is easy to install in any position on a machine. Features simplified piping and adaptability to any type of motor drive. Gardner-Denver Co., Quincy, Ill. **(13)**



SCREEN. Wedge-Slot screen has double the open area of other dewatering screens. Stainless steel bars have a V-shape profile. Type 10A has openings ranging from 0.004 to 0.04 in.; Type 15A from 0.012 to 0.06 in. Hendrick Mfg. Co. **(14)**

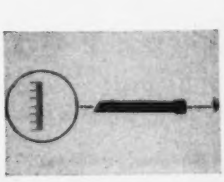
EYE-SAVERS with comfortable, soft plastic frame fit over all prescription glasses. Available in clear, or light, medium or dark green lens. Special ventilation for splash protection can be provided. Watchemoket Optical Co., Providence, R. I. **(15)**



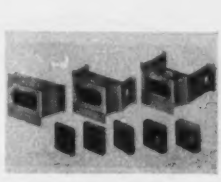
PUMP is designed with scoop rotor and roller type vanes for handling erosive wettable powder solutions. Self-priming it will deliver 7½ gpm. at 100 psi. Speeds to 1,800 rpm. Weight 4½ lb. net. Hypro Engineering, Inc., Minneapolis, Minn. **(16)**

VARIABLE SPEED MOTOR features control handwheel and indicator dial and 5-ft. flexible cable for remote control. Type 5VA is available in ¼, ⅓, ½, and ¾ hp. in speed ratio up to 10 to 1 over a range of 4 to 10,000 rpm. U. S. Electrical Motors, Inc. **(17)**

SCINTILLATION COUNTER can be operated from plane or moving vehicle. Weighs only 4 lb. Ranges are 0.05, 0.5 and 5 milliroentgens and accuracy is within 5% of ¾ full scale reading. Made by Precision Radiation Instruments, Los Angeles, Calif. **(18)**



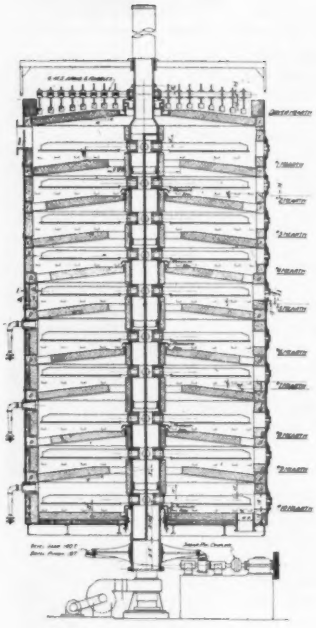
POCKET MICROSCOPE uses engraved scale to make linear measurements. Reads directly to 0.002 in.; estimates can be made to 0.0005 in. "Optometer" is priced at $19.50 complete with leather carrying case. Manufactured by National Instrument Co., Baltimore, Md. **(19)**



INSERT FOR CONCRETE saves time and labor by eliminating "fishing" to get bolt started in nut after nut is placed in insert. Nut can go on bolt before placing insert. Will support loads up to 2,400 lb. Super-Grip Anchor Bolt Co., Inc., Philadelphia, Pa. **(20)**

Improved
SKINNER
Multiple-Hearth Roasters

3½′ to 22′ in dia. for laboratory, pilot plant and commercial operations.



SKINNER ROASTER GENERAL ARRANGEMENT

The Skinner Roaster, as manufactured by CIW, has produced outstanding results for many years on roasting and calcining ores, clays, limestone, limestone mud; decomposing oil sludge to recover sulphuric acid; incinerating sewage, either as garbage or digested sludge to inert ash. Coal, oil or gas fired.

IMPROVED DESIGN

The current models include all of the advantages of the well-known Skinner Roaster . . . easy access during operation; quick replacement of rabble arms and teeth without cooling; cross draft and multiple gas offtakes provide wide range of temperature control.

In addition, an improved bearing arrangement results in greater efficiency and lower costs. The top guide bearing is self-lubricating; the bottom is totally enclosed spherical roller type.

It is available in sizes from 3½′ inside diameter experimental model, with 4, 6 or 8 hearths; up to 22′ with as many as 12 hearths.

COLORADO IRON WORKS CO.

1624 17th Street • Denver 2, Colorado

AKINS CLASSIFIERS • SKINNER ROASTERS • LOWDEN DRYERS

Sales Agents and Licensed Manufacturers in Foreign Countries

A SUBSIDIARY OF THE MINE & SMELTER SUPPLY CO.

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

SYNTRON EQUIPMENT. Miniature catalog #535 provides pertinent data on the entire line of equipment manufactured by Syntron Co., Homer City, Pa. (41)

RESEARCH. Two booklets, "Research in Engineering Economics", and Research in Production Engineering" show you how Battelle Memorial Institute stands ready to serve you in both these fields. (42)

ROLLER CHAIN. This comprehensive 142-page book gives detailed engineering information covering the selection, installation, lubrication and maintenance of roller chain for drives and conveyors and sprocket wheels. A "must" for master mechanics and maintenance engineers. Link-Belt Co., Chicago, Ill. (43)

RUBBER-TIRED TRAILERS. The complete line of rubber-tired hauling trailers made by Athey Products Corp., Chicago, Ill., is described in a four-page cartoon-style booklet. (44)

CAP LAMP. The Wheat "Forty Niner" electric cap lamp and automatic charging rack are detailed in a six-page bulletin from National Mine Service Co., Beckley, W. Va. (45)

CRUSHER SELECTION. To assist "the man who, sometime, may want to select a crusher," Pennsylvania Crusher Co., Philadelphia, Pa., has prepared a handbook that explains in non-technical manner the various crushing methods and where they apply in crushing procedure. (46)

TURNOVER CONVEYOR. By turning a conveyor belt over at each end of the system, you eliminate wear and tear on the belt and return idlers, cut spillage and clean-up work. Upkeep on belts and equipment is reduced. See for yourself; read all about it in a folder put out by B. F. Goodrich Co., Akron, Ohio. (47)

WEIGHING, BATCHING, PROPORTIONING. Catalog 241 contains 56 pages of pictures, data and description of equipment that comes under the headings of weighing, batching and proportioning, made by Jeffrey Mfg. Co., Columbus, Ohio (48)

THERMOCOUPLES. Well arranged 44-page booklet (EN-52) has lots of information on available couples and couple assemblies for general applications, plus a section on special couples for plant and lab. Leeds & Northrup Co., Philadelphia, Pa. (49)

ION-EXCHANGE. Leaflet No. 4062 tells you all about the Dorrco "D-I" zeil for processes using ion-exchange. There is also information on the Dorr Co. (Westport, Conn.) service available for ion-exchange from problem analysis to initial operation of a plant. (50)

INSTRUMENTATION LITERATURE. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., have put out an index of all their technical literature available. (51)

LUBRICATION. An excellent treatise on the lubrication of mining, concentrating and smelting machinery is available from the Texas Co., New York, N. Y., who published the article in the May issue of their magazine, Lubrication. (52)

ELECTRODES. Carbon and amorphous graphite electrodes are the subject of an attractive 12-page booklet published by Great Lakes Carbon Corp., Niagara Falls, N. Y. (53)

MELTING FURNACES. Operation of stationary and tilting-type two-chamber melting furnaces is explained and illustrated in an eight-page bulletin issued by Lindberg Engineering Co., Chicago 22, Ill. A rating-capacity-dimension table and a list of typical applications are included. (54)

DRILLING. Installation photos, case history figures, specifications and lists of accessories feature two bulletins on the different types of McCarthy drills for blast-hole drilling. Salem Tool Co., Salem, Ohio. (55)

LOCOMOTIVE SELECTION. "Selecting the Proper Locomotive" will be a big help to anyone faced with specifying a locomotive for mine haulage. Included are important tables giving all the information you need. Goodman Mfg. Co. (Mancha Storage Battery Locomotive Div.), Chicago, Ill. Should be in every mining engineer's files. (56)

DUST CONTROL. "Industry Relies on 'Dustube' for Efficient Dust and Fume Control" tells how cloth-type dust collectors are handling complex problems in 33 typical installations. All are illustrated. American Wheelabrator & Equipment Corp., Mishawaka, Ind. (57)

CLASSIFIERS. Operation of sand drag-type dehydrators is explained in bulletin by Pioneer Engineering Works, Inc., Minneapolis, Minn. Includes cutaway drawing showing construction features, complete specifications, and capacities. (58)

AERIAL SURVEYS. Photogrammetry—what it is and how it can help you—is covered in an attractive and informative booklet put out by Abrams Aerial Survey Corp., Lansing, Mich. (59)

REAR DUMPS. Catalog sheet covering models 1FFD and 4FFD rear-dump Euclids of 34-ton capacity has been released by Euclid Road Ma-

USE THIS CONVENIENT CARD

to obtain further information on products and bulletins mentioned in the New Products Digest. Circle item numbers, tear out and mail.

Not good after January 1, 1953, if mailed in the U. S. or Canada.

Engineering and Mining Journal—November, 1952
NOT GOOD AFTER JANUARY, 1953—If mailed in U. S. or Canada

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	8	15	22	44	51	58	65	72	79
2	9	16	23	45	52	59	66	73	80
3	10	17	24	46	53	60	67	74	81
4	11	18	25	47	54	61	68	75	82
5	12	19	41	48	55	62	69	76	83
6	13	20	42	49	56	63	70	77	84
7	14	21	43	50	57	64	71	78	85

My Name ..... Position .....

Company .....

Address .....

chinery Co., Cleveland, Ohio (60)

SILICONE RUBBER. "Imagineering with G-E Silicone Rubber" is a 24-page bulletin (CDS-3) with comprehensive information on properties, applications, classes and design specifications of silicone rubber. General Electric Co., Pittsfield, Mass. (61)

ORE FEEDERS. Bulletin F2-B3 has drawings, and engineering data on the complete ore feeder line of Denver Equipment Co., Denver, Colo. (62)

DERMATITIS CONTROL. "Skin-Cote" creams and lotions provide the answer for almost all industrial dermatitis. Folder tells all about the different items and what they are specifically used for. Boyer-Campbell Co., Detroit, Mich. (63)

RADIAL AIR COMPRESSORS. Two-stage, air-cooled, radial air compressors, capable of producing 85 to 125 psi with a variety of drives, are described in the 12-page bulletin, H-830-B1, published by Worthington Corp., Harrison, N. J. (64)

TELSMITH PRODUCTS. The complete Telsmith line from crushers to bin gates is thoroughly covered in Bulletin 256R, a 36-page buyers guide. Catalog is well illustrated and gives comprehensive tables on sizes, capacities, weights and power requirements. Smith Engineering Works, Milwaukee, Wisc. (65)

DIAMOND BITS. The last word on Sprague & Henwood, Inc. (Scranton, Pa.), coring and non-coring diamond bits. Should be in your files if you are concerned in any way with diamond drilling. (66)

MULTI-PURPOSE HOSE. Thermoid Co., Trenton, N. J., has replaced 18 hose types formerly offered with their new "Basic Five." The latter are color-coded, multi-purpose, and an eight-page bulletin tells all about them. (67)

ELECTRICAL PRODUCTS. This bulletin is called "Electrical Connector Products for Coal Mining" but the information about portable electrical connectors, power distribution centers, portable lighting, track switch throwers and cable jacket vulcanizers, should find application in metal and nonmetallic mining too. Joy Mfg. Co., St. Louis, Mo. (68)

pH CONTROL. A review of pH theory and its practical applications in industrial measurement and control, are contained in Bulletin 430-1, issued by Foxboro Co., Foxboro, Mass. The 16-page booklet is profusely illustrated to show details and accessory equipment. (69)

MINERAL DRESSING BIBLIOGRAPHY. A must for millmen is the Dow Chemical Co. annual bibliography covering flotation research, mineral dressing equipment and processes, Heavy-Media-Separation, and literature on milling operations in general, indexed by company or plant name. (70)

HARDFACING ALLOYS. Wall Colmonoy Corp., Detroit, Mich., gives you information on their various hardfacing alloys, with properties and specific applications. (71)

FABRICATED FITTINGS. As a practical help in planning piping layouts, Naylor Pipe Co., Chicago, Ill., has a bulletin on standard and fabricated fittings. Data includes specifications and prints on standard fittings for lightweight pipe and illustrates special fabrications. (72)

WIRE AND CABLE. Comprehensive data on construction and operating characteristics for more than 500 different types of cable and wire can be found in this 186-page general catalog issued by U. S. Rubber Co., New York, N. Y. (73)

SILICONES. This booklet describes only the liquid methyl silicones that Dow Corning (Midland, Mich.) calls "Dow Corning 200 Fluids." These fluids are produced in viscosities ranging from 0.65 to 1-million centistokes at room temperature. Their applications include damping fluids, instrument fluids, hydraulic fluids, liquid dielectrics, lubricants, release agents, water repellent treatments, polishing agents, foam depressants and additives. Properties and applications are discussed in detail on 32 pages. (74)

AIR EXPRESS. This interesting folder discusses 10 advantages of Air Express and gives you the facts about rates and service. (75)

CATERPILLAR MAINTENANCE. Maintenance practices are simplified for operators of DW21, DW20, and DW10 tractors in a 24-page, cartoon-type booklet being issued by Caterpillar Tractor Co., Peoria, Ill. (76)

PUMPS. Drawings, photographs, tables, sections tell you all about "pumps for abusive applications" in 36-page Catalog No. 5206, from Nagle Pumps, Inc., Chicago, Ill. (77)

FIBERGLAS SAFETY HAT. Lightweight hard boiled cap offers ½ in. more space between the hammock and crown than the 1¼ in. required by safety codes. This makes it cooler for the wearer. Brim of the cap is shaped to form a rain trough. The crown is grooved to hold the lamp wire. Cap is made in one size with adjustable head bands to fit all heads. Safety First Supply Co., Pittsburgh, Pa. (78)

WIRE CLOTH. Here is an excellent 125-page book that not only does a thorough job of cataloging wire and filter cloth made by the Multi-Metal Wire Cloth Co. (New York, N. Y.), but provides sections on research into wire and filter cloth structures and a set of relevant technical data that give it a handbook value. Generous amounts of photographs, drawings and tables give the engineer plenty of help. (79)

GEARS. Maintenance men and those designing equipment for their mines will find plenty of useful information on gears, gears and pinions, bevel gears, two-segment tires, trunion rollers and sheaves, made by Stroh Process Steel Co., Pittsburgh, Pa., in this 16-page catalog. (80)

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World's largest deep frame jaw crusher is protected by Farval lubrication

FARVAL—*Studies in Centralized Lubrication* No. 133

IN the next few months, this mammoth machine will crush three million tons of diorite. Largest deep frame jaw crusher ever built, it is operating on the Detroit dam project in western Oregon.

A highly publicized feature of this project is the cooling of all the aggregates used in the concrete construction. The builder of this crusher insured that the bearings in his equipment would always run cool, too. He equipped it with a Farval Centralized Lubrication System.

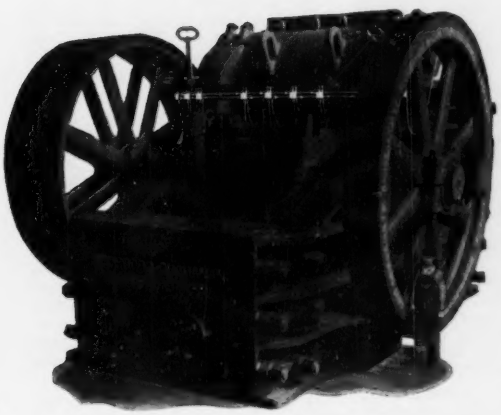
With Farval on the job, no special oilers are needed, lubricant consumption is reduced, bearing life is extended indefinitely and shutdowns for oiling or bearing replacement are eliminated. In short, Farval insures that the crusher can work day in, day out, without interruption from overheated bearings, in doing its part to see that the great Detroit dam is finished according to schedule.

Farval is the original Dualine system of centralized lubrication for industrial equipment, proved practical in 25 years of service. The Farval valve has only two moving parts—is simple, sure and foolproof, without springs, ball-checks or pinhole ports to cause trouble. Through its full hydraulic operation, the Farval system unfailingly delivers oil or grease to each bearing—as much as you want, exactly measured—as often as desired. Indicators at all bearings show that each valve has functioned.

In or near your city there's a Farval engineer, ready to discuss your lubrication problems and suggest a proper system to meet your particular needs.

The Farval Corporation, 3281 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.



KEYS TO ADEQUATE LUBRICATION—*Wherever you see the sign of Farval—the familiar valve manifolds and dual lubricant lines—you know equipment is properly lubricated. Thus you can see there will be no bearing trouble on this Birdsboro-Buchanan crusher.*

This giant weighs 275 tons, stands 18 feet high, has a 66- x 84-inch jaw opening. It handles feed from a 5-cu.-yd. shovel, discharging a 14-inch product at the rate of 800 t.p.h. It is one of more than fifty thousand industrial machines whose bearings are protected by Farval.

Photo above by courtesy Birdsboro Steel Foundry & Machine Co.

PERSONAL NEWS

MR. AND MRS. PHIL DODD and their nine-months-old son, of Grand Junction, Colo. (left) and MR. AND MRS. FRANK FRANKOVICH and their three children of Butte, Mont. enjoy the winter sun on the sea coast at Darwin, Aus. Mr. Dodd and Mr. Frankovich are geologists of the U. S. Atomic Energy Commission assisting in the search for uranium in northern Australia.

Francis O. Case, vice president of Anaconda Copper Mining Co., New York, N. Y., has been named president of Anaconda Aluminum Co., new subsidiary near Columbia Falls, Mont. **H. G. Satterthwaite** is general manager.

Professor J. A. S. Ritson has been elected president of the 1953-54 session of The Institution of Mining and Metallurgy, London, Eng. Professor Ritson has been vice president for the past three years and has served on many government and departmental committees.

S. G. Lasky, who was on full-time loan from the Department of the Interior to the Paley Commission as special consultant, has been designated as the representative of the Secretary of the Interior on the Interdepartmental Stockpile Committee of the Munitions Board.

H. F. Grace has succeeded **W. A. Pope**, retired, as general manager of Nchanga Consolidated Copper Mines, Northern Rhodesia, Africa. **H. E. Nelems**, manager of Rhokana Corp., Ltd., N. R., will succeed Mr. Grace as manager of Nchanga, while **L. W. Allen**, assistant manager at Nchanga, will become manager of Rhokana.

Walter E. Seibert, Jr. has resigned as resident geologist at Reynolds Mining Corp. bauxite operations in Alexander, Ark. He is now assistant to the president of St. Lawrence Corp. of Newfoundland and associated operations.

Stephen T. McGinnis, associate director since January, has been appointed director of public relations for U. S. Steel in its Southeast district. **John L. Mortimer**, interim director for the Southeast, continues as director of the Gulf-Southwest district, with headquarters in Houston, Tex.

Vincent P. Gianella, chairman of the department of geology-geography, MacKay School of Mines, University of Nevada, Reno, has retired after 29 years. Also retiring is **Walter S. Palmer**, professor of metallurgy and chairman of the department of metallurgy and senior member of the faculty, after 42 years. Succeeding the posts are **John S. Winston**, metallurgist, and **Lon S. McGirk, Jr.**, geologist.

Dr. A. F. Banfield of Behre Dolbear & Co. of New York, N. Y. has returned to the city from Ontario, where he has been directing a geological survey field party. **Parke A. Hodges** of the company is making mine examinations in South America.

J. H. Lindemuth, works manager of Kaiser Aluminum & Chemical Corp.'s Mead and Tacoma plants, has been appointed manager of Kaiser's new reduction plant at New Orleans, La. He will be succeeded by **Walter Bast**, formerly assistant manager, as manager of the Mead reduction plant. **C. P. Love**, formerly manager of the New Orleans plant, has been appointed manager of the Tacoma reduction plant. **A. F. Garcia**, formerly of Tacoma, is being transferred to New Orleans.

J. M. Ehrhorn, U. S. Smelting, Refining and Mining Co., has been assigned to special duties in the company's western operations. **Max M. DuBois** has been appointed assistant to Mr. Ehrhorn, and **Benton Boyd** has become general superintendent of the U. S. and Lark mine, succeeding Mr. DuBois. **Harold Wells** has been promoted to superintendent of the Lark section and **Clyde Gillam**, engineer, has become assistant superintendent.

Frank E. Johnson, Washington, D. C., has been appointed deputy administrator of the Defense Minerals Exploration Administration.

R. H. Glover, Butte, Mont., vice president and general counsel of Anaconda Copper Mining Co., has been elected a director of Andes Copper Mining Co. and Anaconda Wire & Cable Co.

E. S. McGlone, New York, N. Y., executive vice president of the Anaconda Copper Mining Co., has been elected a director of the Chile Copper Co.

R. E. Shinkoskey, formerly superintendent of the Selby lead smelter, has been promoted to assistant manager of the southwestern smelting department, American Smelting and Refining Co., El Paso, Tex. **Frank Moran**, formerly of Mount Isa, Queensland, Aus., has been made smelter superintendent at the Selby plant.

J. F. Frost, milling engineer for Buchans Mining Co., Newfoundland, Can., has been named mining engineer, Salt Lake City, Utah, for western department, American Smelting and Refining Co. Mr. Frost succeeds **J. G. Piercy**, who has been assigned to a New York, N. Y., post.

Dwight M. Lemmon, Fair Oaks, Calif., is enroute to Iran, remaining until January as project chief on a Point Four mission at the request of the Iranian Government.

A. A. Friedman is now with Kilembe Mines, Ltd., Uganda, British East Africa, as general superintendent.

J. Frank Sharp has been appointed chief geologist of Consolidated Copper-mines Corp. with headquarters at Kimberly. He was former exploration superintendent for the company in Arizona.

Joseph S. Imirie has been appointed assistant to the president, Carborundum Co., Niagara Falls, N. Y.

H. A. Doerner, metallurgist with the U. S. Bureau of Mines, has joined American Chrome Co., Mouat, Mont., as metallurgist.

James E. Laurie, research chemist at Kaiser's Trentwood Aluminum plant, has been named chief chemist of the Kaiser Bauxite Co. in Jamaica.

A. A. Almstrom has left Bralorne Mines, Ltd., B. C., to join Barvue Mines as mill superintendent at Barraute, Que.

H. Donn Kerosey, president, Anaconda Wire and Cable Co., is serving as chairman of the Metal and Mining Division of the 1952 Fund Raising Campaign for New York City's Travelers Aid Society. **Joseph Terbell**, president, American Brake Shoe Co., will head up the Machinery Division.

C. W. Wright, consultant, is now in Brazil, following the completion of an assignment in Mexico.

The William H. Brady scholarship has been awarded to **Paul J. Resker** of the scrap metal department, The American Metal Co., Ltd., New York, N. Y. and **Philip T. Foxe, Jr.**, Carteret, N. J. Mr. Foxe is in the purchasing department, United States Metals Refining Co. The yearly all-expense award has been established for AMC and USMR employees.

At the Grand Junction, Colo., Exploration Branch, U. S. Atomic Energy Commission, **Ambrose J. Shea** and **Melvin A. Swanson** have been promoted to mining engineer and geologist, respectively. **Kenneth J. Rogers** and **Dana R. Kelley** have joined the branch as geologists. At the New York Technical Services Branch, **Robert G. Coleman** is mineralogist.

A. J. Steel has resigned as mill superintendent at Emperor Mines, Vatukoula, Fiji, and is now chief metallurgist with King Island Scheelite, Ltd., Grassy, King Island, Tasmania.

Frank E. Johnson, special assistant to the administrator since 1951, has been appointed deputy administrator of Defense Minerals Exploration Administration, Washington, D. C.

Alan T. Broderick, formerly with the M. A. Hanna Co. as regional geologist, is now chief geologist with Inland Steel Co., Iron River, Mich.

Glen C. Waterman has been appointed chief geologist of the Chile Exploration Co., Chuquicamata, Chile.

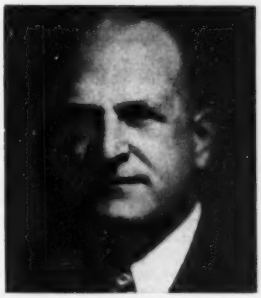
J. F. Findlay, Howe Sound Co. representative for their Mexican properties for the past 14 years at El Paso, Tex., has retired. Mr. Findlay is living at 184 144th Ave., Madeira Branch, Fla. His successor at El Paso is Bryan W. Brown, formerly of San Luis Potosi, Mex.

Edward S. Frohling is now southeastern representative for Western Machinery Co. and Western-Knapp Engineering Co., with headquarters in Birmingham, Ala.

Marcus M. Chapman has been appointed assistant general manager of sales-distribution, United States Steel Co., Pittsburgh, Pa. **James P. Barton** is manager of sheet and strip sales.

F. V. Richard will replace **J. Fred Johnson** as manager of operations, western department, American Smelting and Refining Co., Jan. 1, 1953. **T. A. Snedden** has replaced F. V. Richard as manager of the southwestern division. **D. R. Purvis** succeeded Mr. Snedden as superintendent of the Silver Bell unit. **W. C. Waidler** has replaced Mr. Purvis as superintendent of the Ground Hog and Deming units, and **D. R. Jameson** has become superintendent of Trench unit.

John W. Svanholm has resigned as assistant chief engineer and geologist for the Haussermann interests (Benguet Consolidated Mining Co., Balatoc Mining Co. and Consolidated Mines), the Philippines. Mr. Svanholm is establishing a practice in Venezuela as consulting engineer and geologist.



DR. LESLIE G. JENNESS has been elected vice president in charge of research of Kennecott Copper Corp., New York, N. Y. With the company since 1951, Dr. Jenness has supervised research activities.

Charles W. Croasdale, New York, N. Y. has joined *E&MJ* as assistant editor. A pre-med student at Stanford University, Calif., Mr. Croasdale worked with Press-Union Publishing Co., Atlantic City, N. J., as an Associated Press editor in Philadelphia, Pa., and as technical writer for the Navy, Douglas Aircraft Co., Santa Monica, Calif. He served as Army corporal during World War II, doing public relations work.

Nelson Severinghaus has been elected president of the Georgia Mineral Society, succeeding **Romeo Martin**, now vice president.

Wayne H. Keller has been appointed director of the chemistry department of National Research Corp., Cambridge, Mass., and will assume the direction of the company's research program for the economical reduction of metallic titanium.

A. B. Chafetz, plant engineer, has been advanced to assistant superintendent, maintenance and engineering department, International Minerals & Chemical Corp., Carlsbad, N. M.

F. V. C. Hewett has retired as director of the nonferrous metals division of the Department of Defense Production and returned to his consulting mining engineering practice in Toronto.

Don S. Burrows has resigned as controller of Reconstruction Finance Corp., Washington, D. C., to become controller of the Atomic Energy Commission.

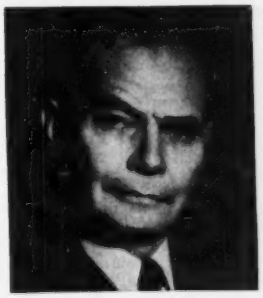
A. G. Haritakis has been appointed mill shift boss at Barvue Mines, Ltd., Barraute, Que.

T. H. Wickenden, vice president in charge of development and research of The International Nickel Co., Inc., has been elected a member of the Welding Research Council of the Engineering Foundation.

W. F. Ryan has succeeded **Joseph Gill**, Wakefield, Mich., as clerk at Pickands, Mather's Plymouth mine. Mr. Gill had been with the company 33½ years.

John A. Schlotic, maintenance boss in the Oliver Iron Mining Division's Virginia, Minn. district shops, has been promoted to shovel maintenance foreman at the Mountain Iron mine.

The Colorado School of Mines, Golden, Colo., has named **Lute J. Parkinson**, mining engineer, as head of its mining department. Mr. Parkinson succeeds **Clifton W. Livingston**, who has resigned to organize his own mining company.



LUTHER R. BRANTING, (left), works manager of Alcoa Mining Co.'s Bauxite, Ark., operations, has retired after more than 32 years' active service. THAD WATTERS, formerly assistant to Mr. Branting, will succeed him.

W. Church Holmes, formerly with Sunshine Mining Co., has rejoined that organization and will be in charge of new projects with headquarters at Spokane, Wash. Mr. Holmes has been with Fluor Corp. as project engineer since 1951.

Frank W. McQuiston, Jr. has resigned from the U. S. Atomic Energy Commission to join Newmont Mining Corp., New York, N. Y. Mr. McQuiston served as deputy director, Division of Raw Materials.

Sheldon P. Wimpfen has been appointed assistant director, Division of Raw Materials, Atomic Energy Commission, New York, N. Y. Mr. Wimpfen will be in charge of uranium production from low-grade sources; **James A. Barr, Jr.**, formerly with the flotation chemicals division of Armour & Co., will be his assistant.

Elton A. Youngberg, formerly district manager of DMEA at Juneau, Alaska, has joined the Division of Raw Materials, AEC, where he will be working on special problems.

OBITUARIES

Fred H. Haggerson, graduate of the University of Michigan and chairman of the board, Union Carbide and Carbon Corp., died in New York, N. Y., on Oct. 4 at 68. Mr. Haggerson, with Union Carbide for over 33 years, became chairman in 1951. He had been named vice president in 1938, a director in 1941, and president and member of the executive committee in 1944.

Marcus L. Anderson, 80, former engineer in charge of underground operations for Tennessee Copper Co., died Oct. 3 in Knoxville, Tenn.

George L. Richert, 54, passed away in Oklahoma City, Okla., May 26. A graduate of the Missouri School of Mines, Mr. Richert served as special assistant to the Minerals Attache at the U. S. Embassy in Mexico City, Mex. In 1947 he joined Dolese Bros. Co., in charge of the engineering department until his death.

Otto D. Rohlfs of Seattle, Wash., died Sept. 25. A graduate of Columbia University, New York, N. Y., and of post-graduate work in mining engineering at the Freiberg Academy in Saxony, Ger., Rohlfs did executive work in California, Alaska and China. During World War II, he served as principal engineer in the mineral division, War Production Board.

Homer McCarty, 84, passed away on Sept. 12 in Salt Lake City, Utah. A graduate of Park College, Parkville, Mo., Mr. McCarty was deputy U. S. mineral surveyor and was instrumental in organizing the Aluminum Company of America.

Daniel M. Kelly, 72, Butte, Mont., passed away on Sept. 24. Mr. Kelly, a graduate of the University of Iowa, was a distinguished lawyer, attorney general of Montana, vice president in charge of western operations of the Anaconda Copper Mining Co., and, at the time of his death, administrative consultant of Anaconda.

Lincoln D. Godshall, 86, former professor of engineering at Lafayette College, died in Los Angeles, Calif., on Aug. 19.

Ralph E. "Sully" Sullivan, 67, died at Thetford Mines, Que., where he was supervising construction of Johnson's Co.'s new asbestos mill.

APPRECIATIONS

Charles Oliver Bergener

Charles Oliver Bergener, born Aug. 12, 1883, in Schullsburg, Wis., departed this world Sept. 27. "C. O." as he was popularly known, attended the University of Wisconsin and established a law practice in his home town. He was one of the men responsible for the rejuvenation of zinc mining in southwest Wisconsin. His friendship and knowledge of leasing was an invaluable adjunct to the successful exploration campaigns in that area.

To those of us who worked with him, he was ever a source of wisdom, wit, and courage. At the time of his death, he was resident counsel for the Calumet Hecla Consolidated Copper Co., Wisconsin branch.

HAROLD B. EWOLDT
Vice President
White Pine Copper Co.

Daniel B. Johnson

Daniel B. Johnson, 65, manager of the Naica Unit of The Fresnillo Co. in Mexico, passed away in St. Mary's Hospital, Long Beach, Calif., on Aug. 16.

He was born in Ulverston, Lancastershire, Eng., and started mining at an early age, learning from the ground up. Later he emigrated to America and the copper mines of Utah and Nevada.

Mr. Johnson, or "Hurry-Up" as he was known to many of his friends, was well known in Nevada and Arizona mining circles, and in Mexico where he had been with The Fresnillo Co. for the last 26 years.

A great lover of baseball, he did a great deal to popularize and maintain enthusiasm for the sport among the employees at Fresnillo.

His greatest hobby was mining, and training of younger men in mining. Many a man in a responsible position today owes his success to Dan's interest and training—the method was sometimes rough, but always to the point.

The mining world and his many friends have lost a well-loved leader, and mourn his loss.

J. H. ASHLEY
General Manager
The Fresnillo Co.

Letters to the Editor

We have received further opinion on the Paley Report, too late to be included with comments printed in the September issue:

JAMES P. BRADLEY
Vice President
Bradley Mining Co.
San Francisco, Calif.

"I would like to call your attention to a serious error on antimony statistics in the Paley Report (Vol. 2, Chapter 9). Per Paley, the total supply of antimony in 1950 was about 12,000 tons in excess of total consumption, whereas the U. S. Bureau of Mines reports supply and demand almost in balance for 1950."

DONALD M. LIDDELL
Chemical Engineer and Metallurgist
New York, N. Y.

"The Paley Report makes the usual protestations that all government agencies do now of being thoroughly in accord with the spirit of free enterprise, but it seems to me that, eventually, it will result in setting up a government-controlled cartel in practically every strategic material and that these will have complete power over production and distribution. I do not see that government cartels are any better for the world than are those of industry.

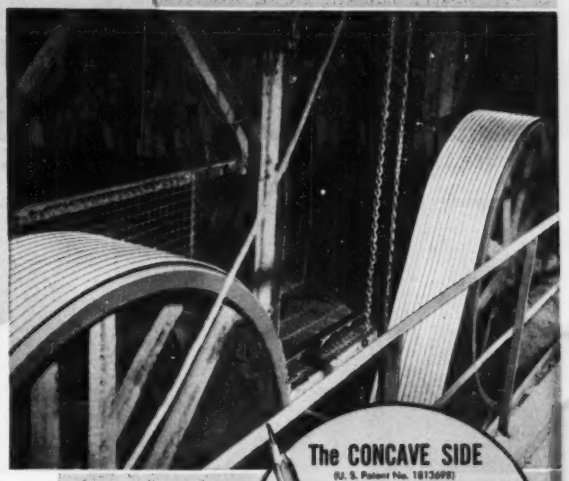
"I have studied the Tin Section with a little more attention than I have some of the others because I was consultant for some years to the Thailand Tin Mines, Ltd. There is, by the way, a very good criticism of this section on page 173 of the *Mining Journal* of London of Aug. 15. While it is stated that the world's ore reserve estimates are all based on published figures, I am very doubtful as to the immense figure for China. Perhaps it isn't worth worrying about this figure anyway, as China seems to be thoroughly in the Red Orbit and, as a matter of fact, you may regard the position of Malaya, Indonesia and Bolivia with some suspicion also. Bolivia is put in there not because it is in the some Continent with the others I mentioned, but because it seems very much inclined toward communism at the present time.

"There seems to be a great deal of smug self-satisfaction as to the position of the United States in the tin world at the present time, but the attaining of this position may cost us a good deal of friendship. I am reminded of the remarks of E. V. Pearce at the company meeting of Lahat Mines last year when he said to his stockholders, among other things, 'What is one to think of the largest tin consuming country in the world, which, after clamoring for increased production from all countries (and getting it), accumulates a very large tonnage for its stockpile, then withdraws from the market because, regardless of conditions obtaining in the producing countries, it cannot purchase at its own price?'"

See for Yourself WHY

Gates Vulco Ropes Wear Longer

These tube mills at the Missouri Portland Cement Co., Kansas City, Mo., were formerly driven by long flat belts. Belt dressing, used to control slipping, picked up dust and built up an irregular cake on the pulleys —causing terrific tension on the belts and shock loads on the bearings. The bearings burned out; belts snapped. Replaced in 1946 by the Gates Vulco Rope Drive shown, belt failures have been eliminated and the drive installation is much more compact.



Make this Simple Test

Take any V-belt that has *straight* sides. Bend that V-belt while you grip its sides between your fingers and your thumb. You will *feel* the sides of the belt *bulge out*—as shown in figure 1-A, below.

Clearly, that outbulge forces the sides of the belt to press *unevenly* against the V-pulley —and this concentrates the *wear* where the bulge is greatest.

Now, make the same test with the belt that is built with the Concave Sides—the Gates Vulco Rope.

Figures 2 and 2-A show clearly what happens when you bend a Vulco Rope. Instead of *bulging*, the precisely engineered Concave Sides merely *fill out* and become perfectly straight. This belt, when bent, precisely fits its sheave groove.

Because there is *no bulging*, the sides of the Gates Vulco Rope always grip the full face of the V-pulley *evenly* and therefore wear *uniformly*—resulting in *longer belt life* and *lower belt costs for you.*

When you buy V-belts, be sure to get the V-belt with the Concave Sides--the Gates Vulco Rope!

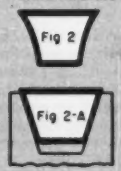
Gates Engineering Offices and Jobber Stocks are located in all industrial centers of the United States and in 71 foreign countries.

What Happens When a V-Belt Bends

Straight-Sided V-Belt

How Straight-Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear At Point Shown by Arrows.

Gates Vulco Rope with Concave Sides



The Concave Sides Fill Out to a Precise Fit in the Sheave-Groove. No Side Bulges! Sides Press Evenly Against the V-Pulley — Uniform Wear — Longer Life!

CS-528-B

Gates VULCO ROPE DRIVES

THE GATES RUBBER COMPANY • DENVER, U.S.A.

V-Belts — Hose
Molded Rubber Goods
for industry
World's Largest Maker of V-Belts

MAURICE TRAVIS (wearing eyepatch) questioned on Communist affiliation by Sen. McCarran (far right) keeps mum.

STANLEY RUTTENBERG, CIO official, tells why CIO tossed out Mine, Mill. He traced parallels between union policy and Communist Party line.

SEN. McCARRAN and counsel.

So Mine, Mill Won't Talk

JACK GOODMAN
Salt Lake City, Utah

"What now, Mine, Mill?"
"What next, Sen. McCarran?"

These questions were left for the general public, mining industry officials, and possibly members of the International Union of Mine, Mill and Smelter Workers to answer, following four days and nights of often bitter probing of alleged Communist activity in the Mine, Mill union.

The hearings before Sen. Pat McCarran (Dem., Nev.) and staff members of his Senate Internal Security Subcommittee held the Salt Lake City news spotlight from Oct. 6 through Oct. 9. Although they drew interesting responses from a few non-Mine, Mill witnesses, the hearings batted a complete zero on the hundreds of queries thrown at Mine, Mill's top officials.

Except for one question, Mine, Mill's leaders simply stood on their Constitutional rights and wouldn't even comment on the weather. Orville Larson, Mine, Mill vice president, stated under oath that he knew of no strike by his union in 1950 directed by the Communist Party. His was the sole answer, other than a refusal, that any of the Mine, Mill leaders gave up.

An official spokesman for the McCarran Committee reported immediately after the hearings that it may be months before the testimony of "friendly," and the non-testimony of "hostile" (i.e., Mine, Mill) witnesses, can be sifted and the record made available for the Senate to consider.

Utah observers felt, however, that Mine, Mill's leaders face the unpleasant task of explaining to the rank and file why, if the charges of Communist influence are untrue, they did not clear Mine, Mill at the hearings.

Basically, the hearings took two courses. First, came an analysis of union policies, with friendly witnesses or experts on the stand. Next came a review of past associations of key union officers, with friendly witnesses telling, under oath, what they knew. Then Sen. McCarran and Sen. Arthur V. Watkins (Rep., Utah) tried vainly to draw answers on past records and testimony from the hostile witnesses.

Following a preliminary closed session with friendly witnesses and experts, apparently to clarify past connections, the public hearings opened on Oct. 6 to a packed house in Salt Lake's Federal Building. Majority of the 250 or more spectators for each public session consisted of Mine, Mill members.

Despite previous rumblings about picket lines and protest strikes, the hearings went off without incident. The hearing room was quiet, beyond the occasional angry rapping of the McCarran gavel as witnesses refused to answer. Said the union's leaders, questioned about possible demonstrations, "We don't run that kind of union. We believe in orderly process."

In opening the testimony, J. B. Matthews, former Dies Committee investigator, and Stanley Ruttenberg, CIO research director, sought to trace parallels between Mine, Mill policies and

(Continued on page 128)

THIS MONTH IN MINING

Paley Report Panel Sparks Warm Discussion As AMC Meets

Tax, Labor Law Revisions Asked

WITH A RECORD-HIGH REGISTRATION well over 1950's peak attendance of 5453, the Western Division of the American Mining Congress held its bi-annual Mining Show in Denver, Colo., Sept. 22 to 25. Over 150 exhibitors demonstrated the newest in mining and milling equipment in Denver's City Auditorium. (See New Products Digest, this issue.) The congress met concurrently in four days of sessions on mining's economic and technological problems.

The Paley Panel

Roundly condemned, and as roundly praised, the Paley Report provided the liveliest Mining Congress session in years. Presided over by Howard I. Young, AMC president, the panel of speakers included Arthur H. Bunker, Climax Molybdenum Co., and George R. Brown, of Brown & Root, both members of the President's Materials Policy Commission, authors of the Paley Report. (See *E&MJ*, Sept., 1952.) The panel of speakers made these points:

Andrew Fletcher, St. Joseph Lead Co., pointed out that the report forecast a deficiency from domestic sources in 1975 of 900,000 tons of lead. St. Joe's figures show a probable deficiency of only 200,000 tons by that time. Mr. Fletcher asked how such discrepancies came about and also asked why the report took such a gloomy view of the lead-supply picture.

Mr. Bunker replied that separate estimates of supply and demand for the future are bound to differ. He said, however, that he felt it impossible to take other than a gloomy view of the lead situation, whatever figures were cited, owing to U. S. mines' inability to produce more than about one-third the lead this country consumes.

Simon Strauss, American Smelting & Refining Co., objected strongly to the Paley Report's suggestion of a study of setting up an international buffer stockpile of metals as an international metal-price stabilizer. He pointed to high cost, danger in building large stockpiles, and probability of political control as unfavorable factors. He felt such a move would discourage, rather than encourage, private investment in mining.

Buffers Not Recommended

Mr. Bunker pointed out that the Paley Report had not recommended establishment of international buffer stocks but only proposed them for study as a possible solution to a serious problem. Mr. Strauss voiced his opposition to even a study of such control methods.

E. H. Snyder, Combined Metals Reduction Co., suggested a national buffer stockpile to stabilize metal prices in the U. S. Metal would be bought or sold automatically by this stockpile's administrators according to the rise and fall of some agreed-upon commodity index.

Thereafter, Donald H. McLaughlin, Evan Just, Ira B. Joralemon, H. C. Dworshak, and Horace M. Albright spoke for and against certain of the report's recommendations. Generally approved by these speakers were the report's proposals on tax reform, depletion allowances, and certain changes in the land laws. Mr. Just, Cyprus Mines Corp., hoped that the report might aid in rebuilding a lively group of prospectors in the U. S. Mr. Albright, U. S. Potash Co., proposed that a committee be set up to study the Paley Report and make specific recommendations for implementing those of its provisions that the committee thought desirable. He moved that the Mining Congress take such action and notify President Truman by telegram that it had done so. The motion was voted upon and approved.

DMPA and Uranium

Reporting on the work of the DMPA, which he administrates, Howard Young said that the programs of assistance for antimony, cadmium, iron ore, and mercury were completed. He foresaw an early end to the copper shortage and mentioned that joint government-industry programs would bring out of the ground in 1955 materials valued at $1.1-billion.

Speaking on the uranium program, Blair Burwell, Minerals Engineering Co., mentioned several technical improvements in drilling and mining practice in the Colorado Plateau, but pointed out difficulties in the way of the prospector. One he mentioned specifically, that of validity of claims made on lands covered by oil leases, was said by AEC representatives to be in process of clearing up.

Commenting on the progress of the Atomic Energy Commission's programs, Henry D. Smyth, AEC commissioner, compared the present status of nuclear physics to that of fire when men first learned to control it by adding either wood or water to the blaze. He believes that the need for uranium for power purposes will grow before the need of uranium for military purposes slacks off; hence, the outlook is for a continuing strong demand for uranium. He mentioned that output from the Colorado Plateau area is greater than that which the U. S. obtains from any other of its sources.

Resolutions Adopted

During other sessions on mining's economic problems, the Congress adopted resolutions expressing the following views:

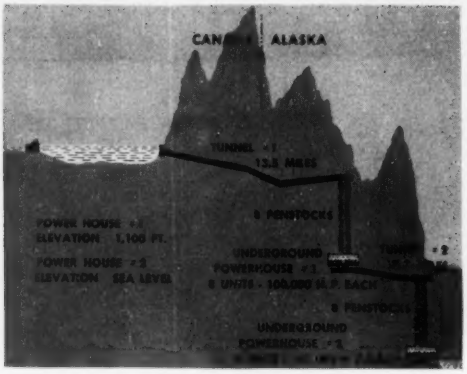
In general: reaffirming its faith in free enterprise; its condemnation of Communists in and out of government; its solicitation of government activities designed to encourage, rather than hamper, greater production of metals and minerals.

On government: that topographic and geologic mapping of the U. S. be accelerated; that control agencies establish no metal price lower than the price paid foreign metal in the U. S.; that controls be removed as soon as emergency conditions end; that stockpiling be adopted as a permanent policy, but be handled with due regard for dislocation of markets; that reasonable protection for domestic mining be provided by tariffs, which might be made flexible.

On the Paley Report: that approval be given the Paley Report's recommendations on geologic mapping acceleration, depletion allowances, expensing exploration costs, encouraging private capital investment abroad, aiding small mines and prospectors; that the recommendations be rejected on: international buffer stocks, direct exploration by government, revision of mining laws to establish leasing and abolish extralateral rights, a permanent DMPA, long-shot investment by the Ex-Im Bank, government loans for foreign mines, foreign management contracts with government, unilateral elimination of tariffs, repeal of the "Buy-American Act" of 1933.

On labor: that Congress should amend the Labor-Management Relations Act to: prohibit compulsory unionism, prohibit labor monopolies and industry-wide bargaining, uproot Communist influence from unions, require the President to use the act in national emergencies, outlaw mass picketing, violence, and intimidation, create a department of employer-employee relations in lieu of the Department of Labor, and certain other provisions.

(Continued on page 129)



ABOVE SKETCH shows ultimate 1.8-billion hp. hydroelectric plant envisaged for Alcoa's Taiya project. First phase, which could be completed in four years, embraces system from lake level to Powerhouse #1, from which water would be drained into Taiya Valley.

AT LEFT, five-lake watershed and proposed site of town and reduction plant (white area) cover 20,000 acres.

Chapman's Nod Enhances Alcoa's Chances Of Breaking Ground at Taiya Next Spring

INTERIOR SECRETARY Oscar L. Chapman's public acclamation of Alcoa's Taiya project apparently confirms statements that the Interior Department has given assurance that enabling legislation will be prepared for early introduction to Congress in January.

Chapman said the department would favor any permanent industrial installation in Alaska. His endorsement, one of several approbations to come out of Washington recently, including that of Nebraska Republican Sen. Hugh Butler, gives impetus to Alcoa's plans to turn the ground next spring. (Estimated time required to complete first-phase construction and begin production is four years.)

Alcoa, however, must first hurdle two high political obstacles. It must acquire:

1) title to that part of the site lying in Alaska and
2) rights to dam and back up Canadian waters.

The gambit for Congressional support includes a promise the government and independent U. S. fabricating concerns will hold option on Taiya output. (Production is too much in the future to estimate stockpile allocations, if any.)

Most impressive Alcoa commitment is the company's announced intention of building and operating on private financing. Customary government inducements were waived in the original announcement of the $400-million project by Leon E. Hickman, vice president and general counsel, who said:

"I think it is significant that this project will be undertaken with strictly private financing, as a matter of American free enterprise. We are not seeking government loans or subsidies . . . We are ready to go ahead with private capital without proposing additional drains on the taxpayers' pocketbook.

"We would even forego any accelerated amortization on the power-generating facilities and would accept certification permitting amortization over a five-year period of as little as 50% of the cost of other facilities making up the project.

"More than that, we would not ask the government to contract to purchase any of the output of . . . facilities nor to underwrite our ability to sell what we produce . . . provided, of course, that Alcoa be given an even break and equal opportunity with respect to other producers and sources of aluminum involved in any future stockpile purchases."

Resistance on the part of the Dominion Government has been anticipated on the theory Alcan's projected Kitimat plant (ultimate capacity 0.55-million tons a year) is predicated on a favorable U. S. market position. If the theory holds water, price of Canadian cooperation might be guaranteed competitive favor over a period of many years in any U. S. stockpile market.

On the other hand, an Alcan spokesman said his company is going ahead on the assumption it can find an adequate commercial market for all the aluminum Kitimat can produce, regardless of military requirements and political vicissitudes. He said Canadian obstinacy would not be surprising, however, in view of the 1½¢-a-lb. tariff on Canadian aluminum imported here. Should the U. S. rebuild its stockpile, he observed, it must either purchase from Canada or encourage U. S. concerns to develop foreign sites with abundant water-power sources.

It is the low cost, stability, and abundance of hydroelectric power that is attracting this ambitious venture to the Yukon. The site, near Skagway, is remote from Alcoa's Surinam* bauxite reserves in Dutch Guiana, from which most of the raw material would be shipped; from U. S. fabricating plants, principal market for the ingot product, and from suppliers. Yet, availability of inexhaustible power is expected to balance high-cost factors.

The industry in the U. S. has been switching to progressively more costly domestic power sources. The already high cost of gas was driven to a nearly prohibitive level by adaptation to gas on the part of Reynolds and Kaiser. Lignite, with which Alcoa is experimenting at Rockdale, Tex., is even more costly.

While Surinam will supply most of the bauxite, some will come from Alcoa's high-silica-content reserves in Arkansas. This source should become increasingly important as technological advances permit commercial recovery from lower-grade ores.

The company has tentatively decided to utilize its domestic facilities for producing alumina before shipment to Alaska. Alternative possibilities not altogether ruled out are

*Rand-McNally spells it both Surinam and Suriname.

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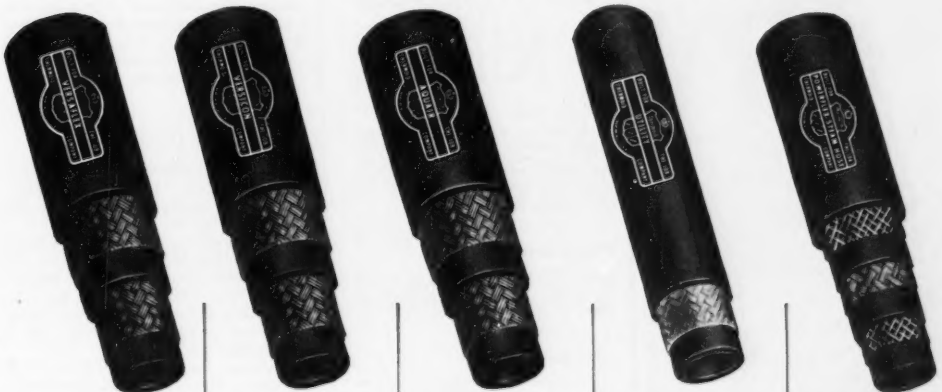

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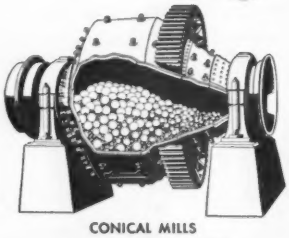
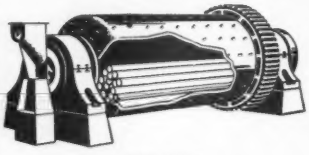
IS GRINDING YOUR PROBLEM?

HARDINGE MILLS



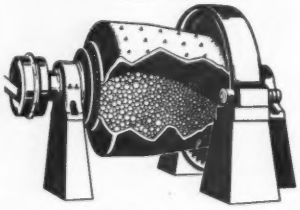
CONICAL MILLS

—The Hardinge Conical Ball (or Pebble) Mill is unequaled in efficiency. Grinds wet or dry, in open or closed circuit. Outstanding feature: natural size segregation of grinding media, from feed to discharge. Bulletin 17-B-1 for dry grinding; Bulletin AH-389-1 for wet grinding.



ROD MILLS

—Same ball segregation effect as obtained in the Conical Mill, plus additional grinding volume. Ideal for large capacity operations. Bulletin AH-414-1.



TRICONE MILLS

—Ideal for producing minimum oversize in open circuit grinding. Grinds either wet or dry. Convex heads reduce friction, prevent congestion of charge at the ends, and align the rods. Bulletin 25-B-1.

TUBE & CYLINDRICAL MILLS

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—The Cylindrical Ball (or Pebble) Mills have demountable trunnions, and convex heads to reduce head liner wear and increase mixing action. Supplied with or without grates, as required. Bulletin AH-389-1.

SEE OFFICE ADDRESSES ON FACING PAGE

HARDINGE

Alcoa *(Continued)*

direct shipment of crude ore or construction in the northwest of an alumina-producing plant to serve the Alaska works and Alcoa's Washington reduction plants at Wenatchee and Vancouver. Domestic facilities are at Mobile, Ala., where capacity is being doubled, the old East St. Louis, Ill., plant, and a third, which only recently went into production, at Bauxite, Ark.

At first phase, annual ingot capacity would amount to 200,000 tons.

(The distantly proposed second phase would cost an additional $300-million, bringing the total to $700-million. It would double power and ingot capacity, raising them to 1.6-million hp. and 400,000 tons a year, respectively.)

The Inside (sea) Passage, through which Alcoa will have a steamship route in operation, would carry most bulk shipments. The site will be readily accessible as well via both White Pass and Yukon Railway and the Alcan Highway.

Hickman said the plant (when both phases are completed) would provide year-round employment for 4,000 and entails building in the wilderness a modern town accommodating 20,000. The site would cover 20,000 acres.

Mine, Mill *(Continued)*

switches in the Communist Party line over the years. (See *E&MJ*, July, 1947, p. 81, where this was done for the first time.)

Mr. Ruttenberg outlined the reasons and the methods for Mine, Mill's expulsion from the CIO in 1950. He indicated the CIO's belief that the ousted union had been given every chance to explain its seeming pro-Communist tendencies.

Next came such former Mine, Mill officials as Ken Eckert (one-time Die-Casting Division executive and self-admitted ex-Communist); Angelo Verdu, now a CIO Steelworkers official; and Harvey Matusow, an admitted ex-Communist. They testified to their belief that top Mine, Mill officials are either card-carrying Communists or Communist "captives."

The list, in addition to John Clark, president, Maurice Travis, secretary, and Orville Larson, vice president, included Herman Clott, Washington representative, Al Skinner, international representative, Graham Dolan, executive aid, Rod Holmgren, assistant union editor, and Clinton Jencks, international representative.

Committee counsel, Donald Connors, introduced into the record documents indicating recent Communist affiliation or party membership of Travis, Jencks, Skinner, Dolan, and Holmgren. In each instance, the Mine, Mill officials declined to identify the documents or to confirm or deny such affiliation, on the ground that an answer might tend to incriminate them.

No documentary evidence was presented covering John Clark, but he likewise refused all answers, also "on the grounds of the Fifth Amendment."

"Friendly witness" Harvey Matusow reported being told at a New Mexico guest ranch meeting with Clinton Jencks that a Communist-inspired strike to hamper copper output would be launched after the start of the Korean War. Jencks refused to confirm or deny this statement or to confirm or deny knowing Matusow. Later Jencks issued a flat denial to Salt Lake City newspapers.

Jencks' refusal to comment in the hearings was followed by Orville Larson's sworn statement that he knew of no strike in 1950 directed by the Communist Party. This was the only clear-cut answer given the committee by any of the Mine, Mill witnesses.

Industry spokesmen who attended the hearings were puzzled by one Mine, Mill tactic. Maurice Travis, who publicly resigned from the Communist Party in 1949 in order to bring his union under the Taft-Hartley Act's provisions by signing the non-Communist affidavit, steadfastly refused at the McCarran hearings to identify his signature on photostats of his non-Communist affidavit, or even to scrutinize the document presented to him by counsel.

Where Travis' position on communism leaves him and the union he represents becomes one more unanswered question. Some felt that mining companies should refuse to accept his signature on a contract, a move that would certainly lead to possible strike action.

The next step in the McCarran investigation is to complete the Mine, Mill hearings in Washington, D.C. The committee report, with any citations for contempt or perjury it may make, will be submitted to the Senate Judiciary Committee.

Should the Judiciary Committee agree, the report would be presented to the Senate as a whole, which, on a majority vote, could turn the evidence over to the Department of Justice with a recommendation that Grand Jury indictments be obtained.

AMC *(Continued)*

On the USGS and the USBM: that these agencies, the USGS in particular, be commended as well-organized, competently-staffed agencies operating in the public interest.

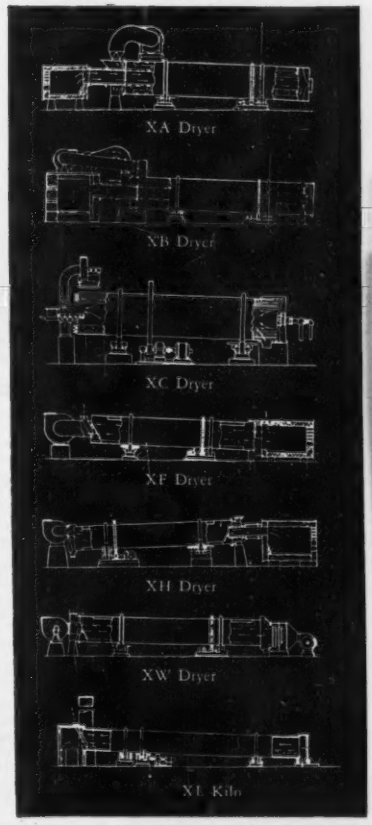
On mine safety: that safety be regarded as a primary responsibility of the mine operator, subject to state regulation alone.

On pollution problems: that studies and action on air and water pollution problems be left to industry and local authorities working jointly.

On equipment: that current policies of the DPA and the NPA be changed to provide greater flow of materials to manufacturers of mining equipment

IS
DRYING
YOUR
PROBLEM?

RUGGLES—
COLES
DRYERS



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—For materials that must be dried by indirect heat but can be heated above 212°. A double shell dryer with low dust loss.

CLASS XC
—Steam tube dryer for materials that must be dried by indirect heat and at low temperatures, such as chemicals, grains, food products.

CLASS XF
—For direct heat drying at temperatures above 212°. A single shell, counter-flow dryer that does not discharge the material through the furnace.

CLASS XH
—For direct heat drying at temperatures above 212°. A single shell, parallel flow dryer designed to handle sticky materials.

CLASS XW
—For material that can be dried by hot air at temperatures below 212°. Dries ammonium nitrate; potassium chloride, etc.

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—Rotary type for drying, calcining, roasting or oxidizing at temperatures above the range of ordinary dryers. Refractory lined.

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—Air water spray or submerged rotary type. Each designed for the efficient cooling of materials from kilns or roasters.

Bulletin 16-D-1 describes entire Ruggles-Coles line.

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AMC *(Continued)*

to enable faster production of needed mining machines and repair parts.

On mine financing: that the SEC give careful consideration, in revising its regulations covering small mine financing, to the suggestions of mining industry associations on this point.

On silver: that the existing federal policy on buying silver be endorsed.

On gold: that the gold standard be restored, with gold and dollars freely interchangeable, and that Congress fix the dollar price of gold on the basis of recommendations of a commission of experts.

On taxation: that the excess profits tax be repealed, that tax exemption be granted a new mine for three years after beginning profitable operation, that steps be taken to create a tax situation more favorable for mining.

Technical Sessions

In the sessions on mining methods, S. S. Clarke reviewed progress toward more effective use of machines underground; for example, in the Tri-State, some mines get better supervision and faster repair by using jeeps, with exhaust cleaners, underground. V. C. Allen, Tri-State Zinc, Inc. reported on his use of truck haulage from the working face underground out through a 1,700-ft., 10-deg. incline directly to the mill. Each truck carries 8.7 dry tons an average distance of 1.1 mi. at a cost of 23.4¢ per ton.

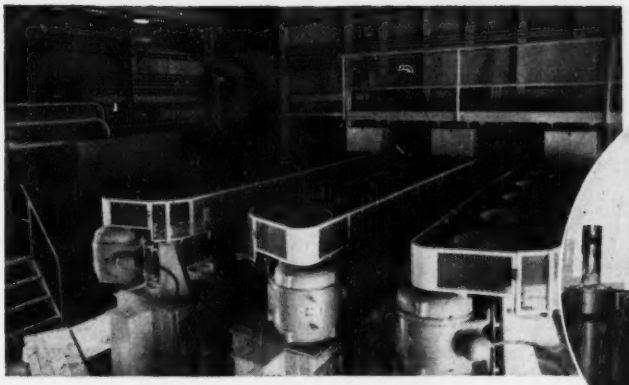
Charles A. Lindberg trucks in Minnesota in 1951 moved 77.5% of the 231-million tons of iron ore and waste carried that year. Trend is toward 35-ton units with about 400-hp. engines, either one or two. Three 50-ton units are now under test, two with 550-hp. butane engines and one 600-hp. diesel job.

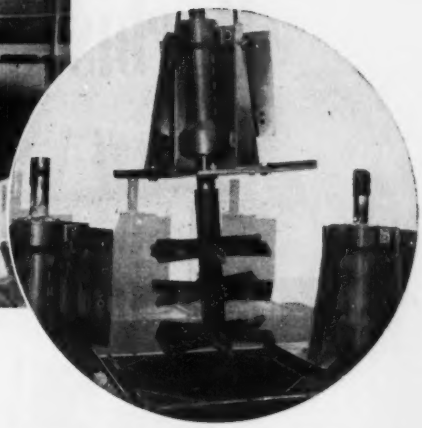
An oil-well rotary rig, drilling in quartzite and porphyry, produced 59,227 lineal ft. in 1,975 hours, averaging 30 ft. per hour, according to G. R. Putnam, Utah Construction Co. These open-pit blast holes were drilled with a Hughes Tricone 7⅞-in. bit, which lasted about 1,800 ft.

In sinking part of a 52-deg. three-compartment inclined shaft at the Stirling mine of New Jersey Zinc Co., a 13-cu.-ft. toothed-lip, dragline bucket was used. Described by F. W. Sauerwein, the bucket was handled by air hoists on the sinking cage. Its peak was 46 skips loaded in one seven-hour period, a total of about 2,200 cu. ft. of muck.

At Iron King, Humboldt, Ariz., L. F. Bombardieri reported that alloy drill steel drilled 6.75 times as much footage per rod destroyed as did straight carbon rods. First cost of alloy steel is about 30% higher, but the 150% saving in life makes it worth-while. The six-month cost of alloy steel was $0.028 per ton, as compared to $0.043 per ton for carbon steel.

Automatic machines for hard-facing milling equipment got a boost from





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Here is a **new** machine that gives you an economical—a **profitable** solution to two important problems:

1 *Efficient processing of ores and industrial sands having excessive surface coatings.*

2 *Liberation of cemented materials.*

If either of these problems exists in your operations, the WEMCO ATTRITION MACHINE will give you improved quality of your product or higher recovery at a given quality.

RECOVERIES INCREASED AS MUCH AS 3 TIMES!

- Actual pilot plant tests of attritioning on the retreatment of tungsten tailings improved recovery from 22% to 68%!
- Similar tests on reflotation of gold from rejects increased recovery from 20% to 65%!
- Glass sand recovery by flotation after attritioning increased from 80% to 95%!

The wide adaptability of the WEMCO Attrition Machine has been proved by actual plant operation and pilot plant tests. Here are a few examples of results obtained:

Tungsten ore—Substantial improvement of flotation grade and recovery in the retreatment of former tailings.

Uranium ores—Liberation of uranium minerals in the cementing material of sandstone.

Glass sand production—Removal of iron oxide stain to meet market specifications.

Aggregate and sand production—Disintegration of sand and clay cementing material from aggregate, saving both aggregate and sands for marketing.

Sulfide ores—Removal of semi-oxidized coatings, making possible flotation recovery—by removal of reagent and oxide coatings on former tailings.

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By controlled turbulence of high density pulps, the WEMCO Attrition Machine thoroughly abrades mineral and ore particles. The imparted action is decidedly more efficient and complete than similar treatment previously attempted by other methods. Power consumption is greatly decreased, averaging 3½ to 7 kw. per ton of capacity. Maintenance and replacement costs are lowered to approximately 1 cent per ton of output.

APPLICATIONS

Treatment of Particle Surfaces

Removal of oxidized coatings
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Removal of reagent coatings
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Liberation of Cemented Minerals

Ores and industrial minerals of this type may be separated, either the particles or the cementing material being recoverable for valuable mineral content.

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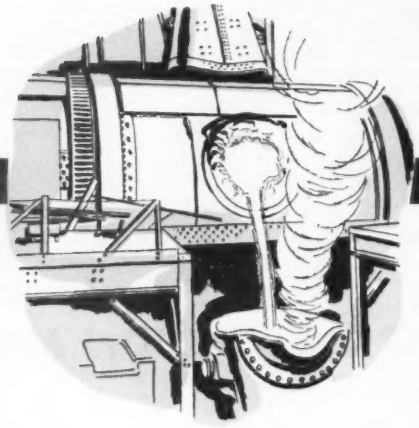

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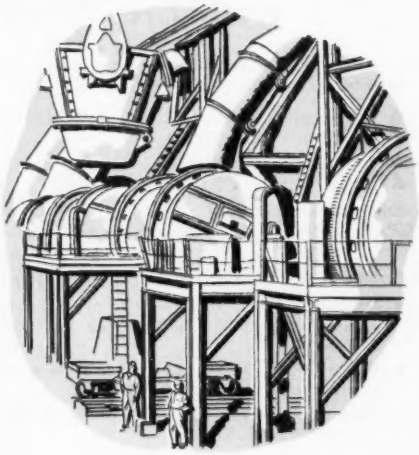
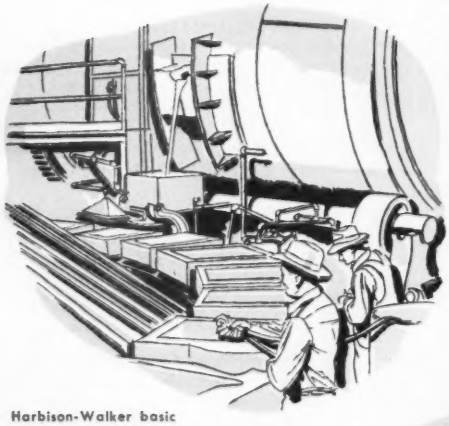
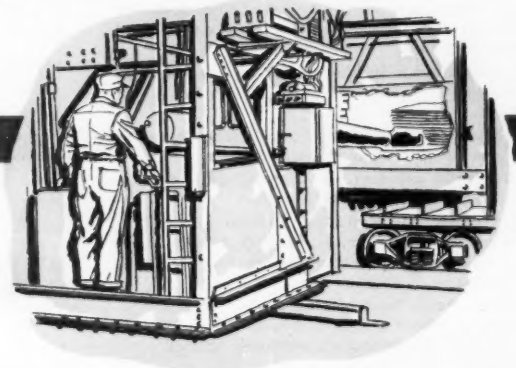




Harbison-Walker basic refractories of several classes are accepted standards for holding furnace linings.



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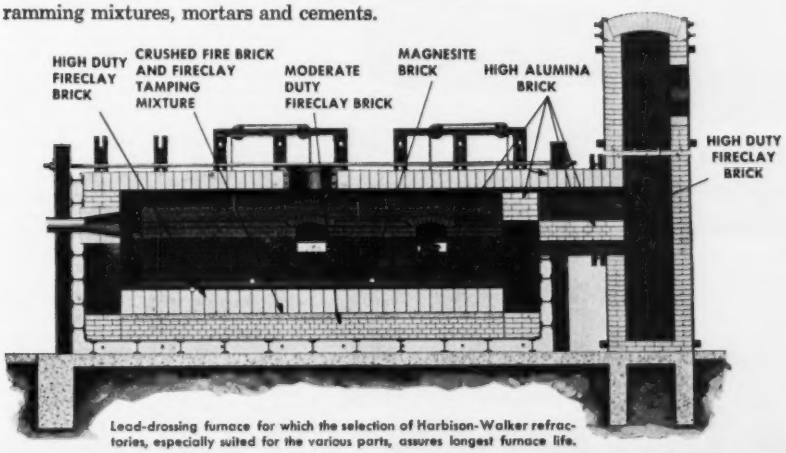
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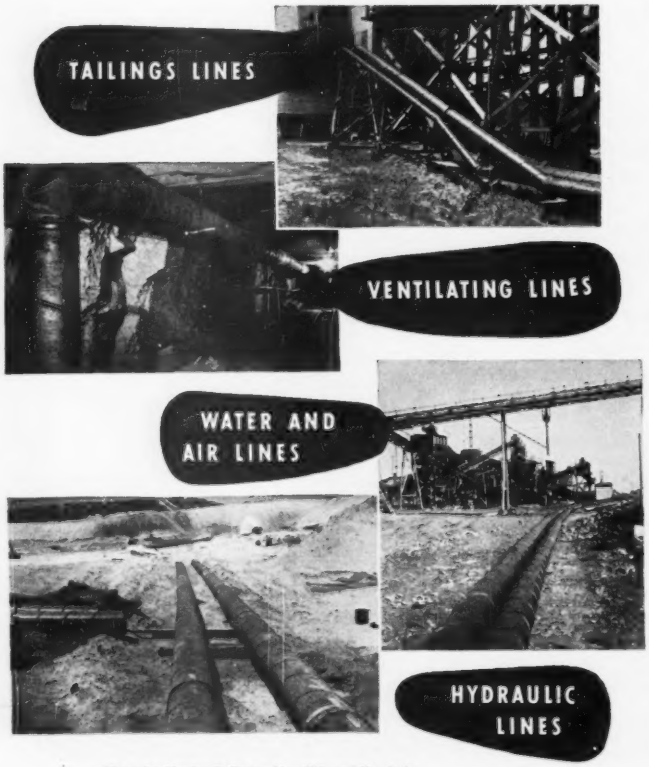

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several operators. N. A. Stockett, St. Joe, reported that machine hard-facing took less time, had lower metal waste, stood up longer. Hand-welded rolls lasted 30 days; machine-surfaced rolls last 50 days at least.

Kennecott at Hayden, J. L. Stevens reporting, has gone to three-stage grinding for increased capacity and a better flotation feed. Equipment added consists of 10½x14-ft. A-C ball mills with 24-ft. Dorr bowl classifiers and 14-ft. Dorr drag classifiers for grinding and classifying between rod mills and final grinding.

Big 3 Tin Mines Seized by Bolivia

JUST WHAT FATE was in store for Bolivia's three great tin producers was still conjectural as this issue went to press. President Victor Paz Estenssoro seized the Hochschild, Patino, and Aramayo mines and placed them under control of Corporacion Minera Boliviana, the government mining corporation he created by decree only a few days before the coup. The committee charged with making policy recommendations governing relations with the dispossessed operators apparently takes the view they should be compensated for investments, machinery, and other equipment but that the wealth underground belongs to the people. There was the possibility even this recompense would be withheld in payment of back taxes. Estenssoro could count on a sustaining opinion from his judiciary should he elect to take this advantage. It is he, himself, who appoints his own judiciary officials.

The Corporacion has appointed receivers and dispatched engineers to manage operations.

The sudden stroke followed months of official statements promising nationalization but came only a few days after reports began to circulate that seizure would precede nationalization in order "to prevent sabotage." That its timing surprised the mining companies may be inferred from the fact that, as late as a fortnite before, the Hochschild group announced it would cease to operate its subsidiary, Compania Minera Unificada Cerro Potosi, effective Dec. 22. Reasons given were conditions of exchange in force regarding settlement for minerals paid into Banco Minero and the company's many obligations.

Only a few days before the seizure, La Paz's ambassador to Washington, Victor Andrade, and RFC Administrator Harry A. McDonald reached agreement for sale to RFC of Bolivia's accumulated tin concentrates, containing an estimated 6,000 to 7,000 long tons of tin, at 117.5¢ per lb. fob South American ports. Sale was to be executed by Banco Minero through its New York agent, Mercantile Metal and Ore Corp.

A RUSH JOB! . . .

Because aluminum is vital to defense, this big plant for Alcoa was a rush job. So the contractor, Thomas Bate and Sons of Houston, called on 5 Limas to excavate, pour concrete and unload materials.

The result! . . . "one year from the time the first concrete was poured, bauxite was delivered to the plant."

A TOUGH JOB! . . .

But speed wasn't the only problem. As the contractor reports, the soil was unusual . . . "it contained a mixture of gravel and aluminum oxide of an abrasive type which had a tendency to wear all moving parts with which it came in contact."

"Despite these conditions, the rugged Limas delivered uninterrupted service during the entire year."

. . . WHERE VERSATILITY PAID OFF

In addition, the speed and adaptability of these Limas made it easy for him to keep work on schedule—overcome difficult problems.

For instance, an 802 Lima was rigged with a 100-foot boom and a 2-cubic yard drag bucket to excavate at 50-feet for the Crusher Building. Again, a ¾ yard Lima Paymaster easily handled all the unloading of aggregate for the 60,000 cubic yards of concrete poured on the job.

Whatever your problem, you'll find a Lima to exactly fit your needs. Each unit has a ruggedness . . . speed . . . ease of operation and maintenance . . . economy to give you high output at lowest cost. So write today.

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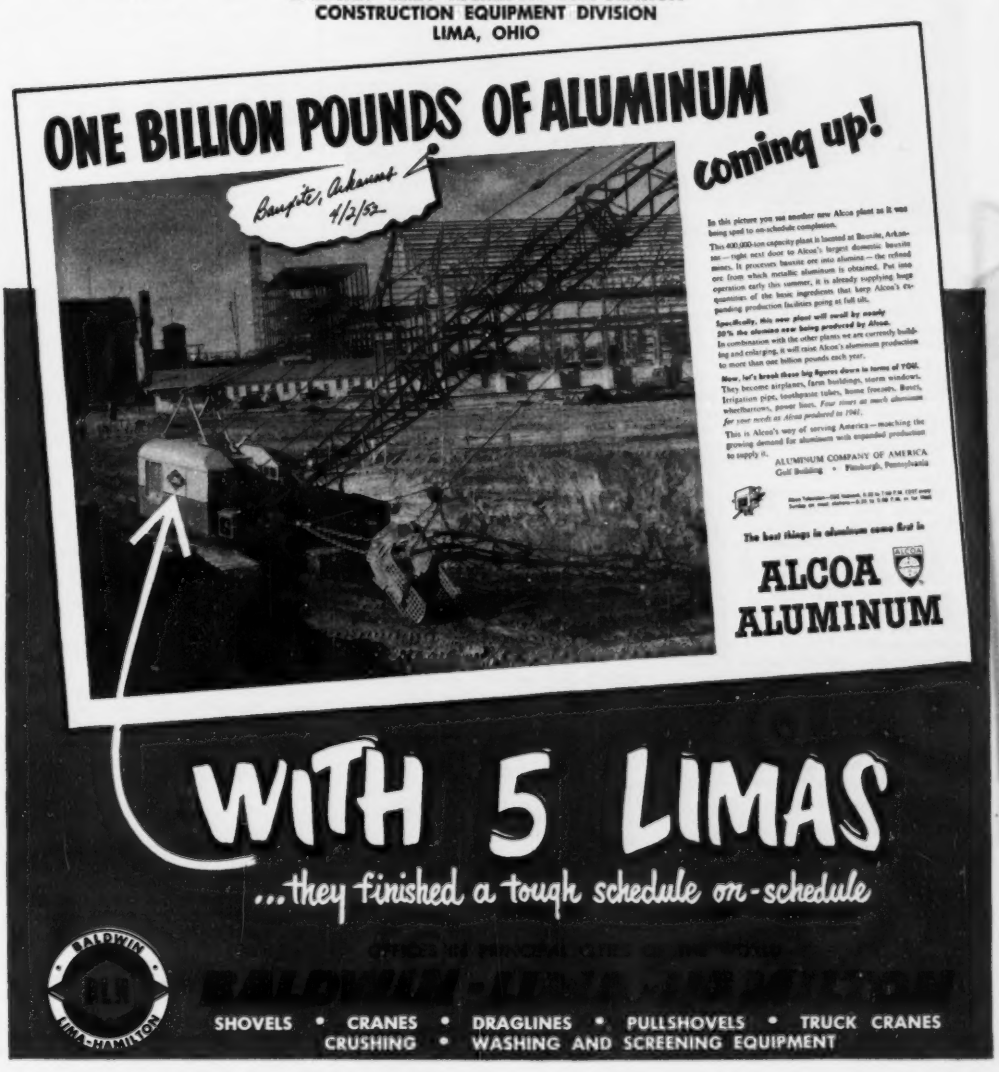
CONSTRUCTION EQUIPMENT DIVISION
LIMA, OHIO


ONE BILLION POUNDS OF ALUMINUM
coming up!
Bauxite, Arkansas 4/2/52
In this picture you see another new Alcoa plant as it was being sped to on-schedule completion.
This 400,000-ton capacity plant is located at Bauxite, Arkansas — right next door to Alcoa's largest domestic bauxite mines. It processes bauxite ore into alumina — the refined ore from which metallic aluminum is obtained. Put into operation early this summer, it is already supplying huge quantities of the basic ingredients that keep Alcoa's expanding production facilities going at full tilt.
Specifically, this new plant will swell by nearly 20% the alumina now being produced by Alcoa.
In combination with the other plants we are currently building and enlarging, it will raise Alcoa's aluminum production to more than one billion pounds each year.
Now, let's break these big figures down in terms of YOU.
They become airplanes, farm buildings, storm windows, Irrigation pipe, toothpaste tubes, home freezers, Boats, wheelbarrows, power lines. Four times as much aluminum for your needs as Alcoa produced in 1941.
This is Alcoa's way of serving America — matching the growing demand for aluminum with expanded production to supply it.
ALUMINUM COMPANY OF AMERICA
Gulf Building • Pittsburgh, Pennsylvania
The best things in aluminum come first in
ALCOA ALUMINUM

WITH 5 LIMAS

...they finished a tough schedule on-schedule

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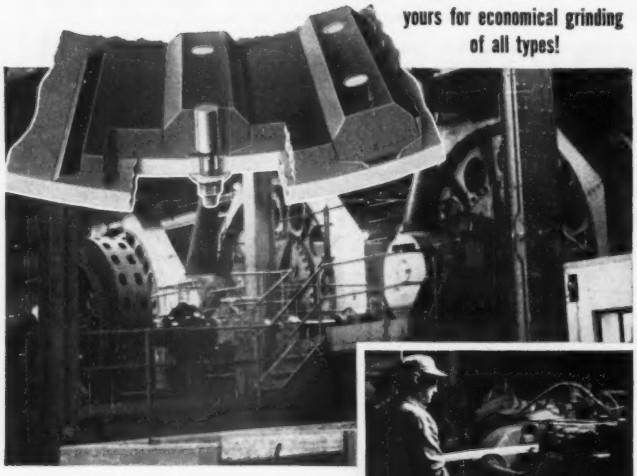
U·S·S LORAIN ROLLED PLATE LININGS AND U·S·S GRINDING BALLS . . .

yours for economical grinding of all types!



● **U·S·S LORAIN ROLLED PLATE LININGS** help you cut grinding costs, increase your mill output. Made to accurate size and in easy-to-handle sections, they can be installed quickly and easily . . . saving hours of installation time and greatly reducing mill down-time. And because the rolled steel from which they're made is so highly resistant to breakage, Lorain Liners of reduced thickness can be used, thereby increasing the usable diameter of the mill . . . and the output!

You'll save on maintenance costs, too, when you install U·S·S Lorain Rolled Plate Linings. They're so rugged they'll wear 'til they're paper thin without failing. And since the plates are interchangeable, severe localized wear at feed or discharge ends of the mill may be balanced just by reversing the worn plates to the opposite ends. Close fits between ends of plates and between plates and lift bars of Lorain Linings eliminate shell wash and allied troubles which result in costly mill repairs.

U·S·S Lorain Rolled Plate Linings are available—in any diameter, length or thickness you need—through leading mill manufacturers whose names will be furnished upon request.

U·S·S GRINDING BALLS can help you effect still lower grinding costs. Made to exacting specifications and carefully tested from raw materials to finished product to assure surface hardness and maximum hardness penetration, U·S·S Grinding Balls provide uniform, efficient grinding action in all types of mills. Available in diameters from ¾" to 5". For further information on U·S·S Grinding Balls send for our free booklet. Just return the coupon below.

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Without obligation on my part, please send me your FREE booklet on U·S·S Grinding Balls.

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UNITED STATES STEEL

Anaconda Organizes Aluminum Company

ANACONDA COPPER Mining Co. recently announced formation of a subsidiary, Anaconda Aluminum Co., to build and operate its $45-million aluminum reduction plant at Columbia Falls, Mont. Francis O. Case was named president, and H. G. Satterthwaite will be general manager.

Alumina will be obtained from Reynolds in Corpus Christi, Tex. Capacity will be 72,000 tons a year when construction is completed in 1954.

Preliminary construction work, started in early September, includes surveying and laying a 1500-ft. service track connecting with the main line of Great Northern Railway. Bulldozers are clearing the area, a temporary power line is being installed, and soil borings are being taken for foundation formation. Power for two potlines will be supplied from Hungry Horse Dam in accordance with an agreement with Bonneville Power Administration.

Wilbur Jurden, the company's chief construction engineer, said building activity would be accelerated in the spring.

It is anticipated aluminum cable manufacture at Columbia Falls will provide a market for much of the output.

Bolivia Leases AS&R Mine at Corocoro

AMERICAN SMELTING AND REFINING COMPANY through its subsidiary, Cia. American Smelting Boliviana, S.A., has negotiated a lease with the Bolivian Government for the operation of its Corocoro (Bolivia) copper mine in accordance with a contract signed October 6. The company paid off employees as of Oct. 7. Severance pay and payment in lieu of notice were made to all employees in accordance with Bolivian labor laws.

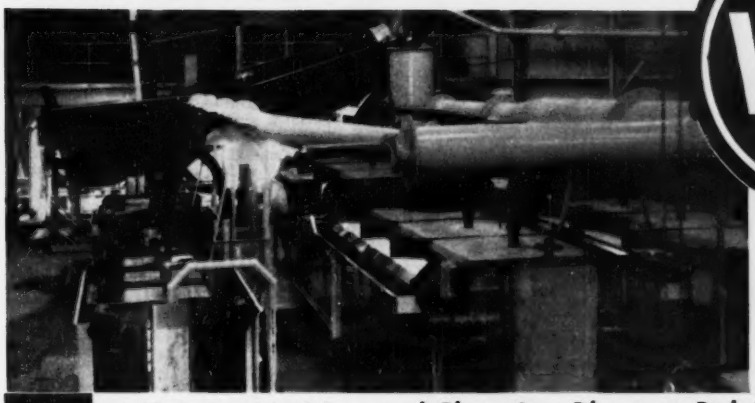
Details were undisclosed by company officials, and Mines Minister Juan Lechin said details of the lease were "favorable for both parties."

In accordance with Bolivian law, Cia. American Smelting Boliviana, S.A., gave formal notice on July 9 that it would cease to operate the Corocoro mine at the end of 90 days. This decision was based on the fact that it appeared economically unsound to continue operations in the light of a long history of labor disorders, often leading to violence, and diminishing ore reserves. This combination of factors, the company said, made for inefficient operation at high cost.

Corocoro, operated by Cia. American Smelting Boliviana, S.A., since 1934, employed 850 workmen and yielded a monthly output of concentrates containing about 300 tons of copper.

DESIGNED FOR PRODUCTION EFFIC

WKE



A Unique Attrition and Flotation Plant at Del Monte Properties

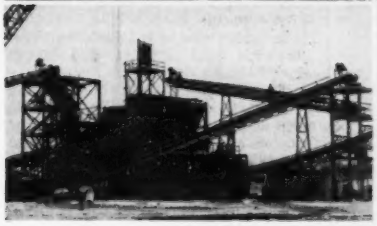
This attrition and flotation plant at Pacific Grove, California, is a typical example of the design and engineering skills available at WKE. Faced with special problems in the separation and extraction of beach sands, WKE engineers designed and erected this plant using a new and effective approach. It is now proving its efficiency in turning out 50 TPH of assorted, premium-quality sand products.

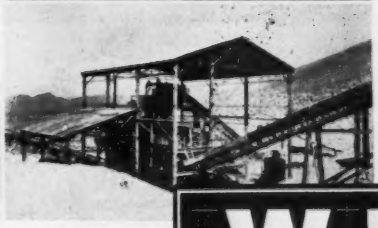
This practical know-how, based on WKE's long experience in mineral dressing, is at your service in the design, engineering and construction of metallic and non-metallic mills.

W. S. MOORE CO.
VIRGINIA, MINNESOTA
Completed in 1951, this 150 TPH heavy media iron washing plant includes a WEMCO Mobil-Mill and auxiliary washing facilities. Design and engineering by WKE.

● *Here Are Other Typical WKE Engineered Plants Recently Placed Into Efficient Production:*

TRIUMPH MINING COMPANY
HAILEY, IDAHO
Designed and constructed by WKE, this lead-zinc selective flotation plant has a capacity of 200 TPH; operation started in 1952.





BASIC REFRACTORIES, INC.
GABBS, NEVADA
Designed and engineered by WKE, this HMS plant processes brucite, turning out 50 TPH. Heart of the installation is a WEMCO Mobil-Mill.

COONS-PACIFIC COMPANY
EVELETH, MINNESOTA
placed this 150 TPH iron washing plant in operation during 1952. Equipment includes a heavy media Mobil-Mill, spiral concentration unit and auxiliary washing equipment. Design and construction by WKE.

If you are contemplating mill design and construction, or expansion of present facilities, write for helpful particulars. No obligation, of course.

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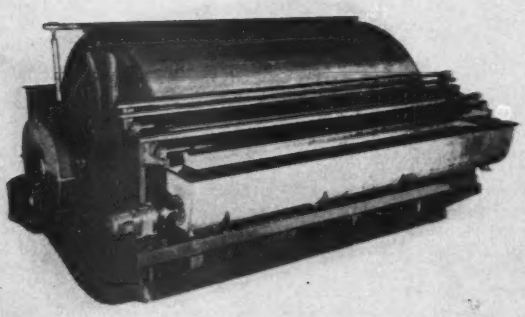
FILTERS



Eimco String Discharge filters are furnished where the nature of the cake makes the use of the string, to lift off the cake, a more desirable feature.

Eimco String Discharge attachments are available for high or low submergence drum filters in a full range of drum size from 25 to 678 sq. ft. of filter area and in laboratory size the Eimco String Discharge filter is proportionally designed with 4 sq. ft. of filter area.

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McCarthy To Mine Sulphur in Bolivia

GLENN H. McCARTHY, the Texas oil man, signed a contract with the Bolivian Government in which the P. P. G. H. McCarthy concern agrees to exploit Bolivian sulphur deposits in Los Lipez over a 12-year period. McCarthy could renew it for an additional eight years, contingent on approval of Banco Minero. The contract becomes effective on approval of MSA, which will launch geological investigations within six months.

Bolivia guarantees security of the operations and agrees to furnish all technical information. The company is to pay royalties amounting to 8% of sulphur exported. Reserves leased to McCarthy amount to about 5-million tons assaying better than 60% sulphur.

Signing of the contract Sept. 11 took place only a few weeks before President Victor Paz Estenssoro seized the nation's privately owned tin mines and while the threat of nationalization was manifest. Apparently the revolutionary government welcomes foreign capital, and its enthusiasm for nationalization begins and ends with the time-festered antagonism for the big three tin producers.

Anaconda Announces Progress at Yerington

ONE-FOURTH OF 10-MILLION TONS overburden has already been removed from the Yerington copper site, A. E. Millar, Anaconda general manager, announced at a recent meeting of AIME at the San Francisco Engineers Club. Millar's statement, read by A. J. Gould, plant superintendent, said progress was on schedule.

Millar estimated daily production would be 11,000 tons yielding 60-million lb. of metal a year, that ore reserves amount to 35-million tons of oxide material and a substantial underlying sulphide ore tonnage. Ore-waste ratio was put at 1:1¾, copper content at 1% plus, cut-off point at 0.6% copper.

Stripping equipment includes shovels with 5-yd. dippers and 25-ton Euclid trucks.

The statement said the company completed excavation of leaching vats each capable of holding 11,000 tons of crushed ore and is now concreting and preparing to erect steel buildings for crusher, shop and acid plant. It estimated total cost at $38-million.

Millar further reported good progress in readying the Leviathan open-pit sulphur mine in Alpine County, Calif., 60 mi. west of the Yerington site. Leviathan is expected to yield 600 tons of ore per day to be trucked to the Yerington acid plant to produce sulphuric acid, which will be used to leach oxide ore. The ore will be treated by the Fluosolids process, resultant gases going to a 500-ton contact plant.

Monetary Fund's Adamant Stand On Gold Price Slows Premium Market

ACTIVITY IN FREE GOLD markets has been sluggish in reflection of the United States' adamant stand in the face of pressure exerted at the recent Mexico City meeting of the International Monetary Fund for upward revision of the official gold price. Free-market prices were depressed slightly on the average, in spite of the fact that an increasing proportion of gold output is being diverted to private hoards and other nonmonetary uses.

The enigma presented by the recent American election, whether the new administration will reinstate the gold standard or stand pat on currency management, paralyzed the delegates. Advocates of a higher official price came away with no more consolation than a promise that the question would be the subject of continuing study.

Nicolaas Christiaan Havenga, chief South African delegate, led the fight for a higher official price; the Australian governor, Sir Arthur Fadden, gave him verbal support.

Canada, whose robust currency puts her (among all the higher-price advocates) in the strongest bargaining position, remained silent. Evidently her attitude was the U. S. couldn't be budged anyhow, and it would be pointless to antagonize this country—at least until the new president has given some intimation of his thinking with respect to the question.

The position of England, France, and other nations hard-pressed for want of foreign credit, seemed to be that wages and prices must be maintained on the current high plateau and that one way to achieve this is to raise the official gold price. The mute participation of Treasury Secretary John W. Snyder implied that countries having a paucity of reserves must face the hard fact of deflation.

Sir Arthur Salter, British Minister of State for Economic Affairs, was passive at the Fund meeting but told a reporter, "It is not improbable that the price of gold will be discussed at the Commonwealth Conference (this month in London)."

Havenga reminded delegates the Fund had fixed 1952 as a target date for balancing foreign reserves of member countries and removing trade restrictions so that currency convertibility could be established multilaterally. In his opinion, disequilibrium of reserves, tariff walls, and restrictive and bilateral trade arrangements make currency convertibility as remote today as it was when Bretton Woods formulated the Fund's policy.

"We have now reached the end of the transition period envisaged by the Fund," he said, "and what do we find in practice? Instead of general convertibility of currencies and unimpeded international trade, we find that the disequilibrium in the balance of payments of many countries is as serious as ever before . . . In the modern state, economic factors have been subordinated to the overriding social objective of full employment, and the effective prosecution of this objective requires a flexible monetary standard . . .

"Short of a substantial increase in the volume of gold production, which can be ruled out under present price relationships, reserves could only be built up to an adequate level either by raising the price of gold or by deflation.

"It would surely spell a major disaster if nations were to rely upon deflationary action to achieve an end which is so necessary to augment their international liquidity.

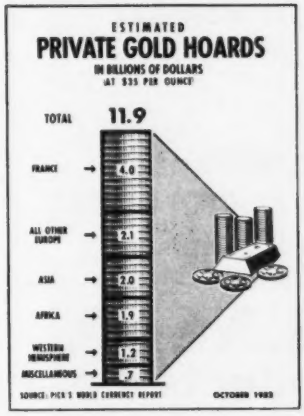
"It is rather unfortunate, however, that a higher purchasing power for gold could only be realized through sales in the free market which deprive the central reserves of many countries of much-needed additions."

Said Chairman Ivar Rooth, presenting the executive directors' report:

"A comparison between the volume of gold production in all countries outside the USSR and its associates and the increase in the official gold holdings of these countries should indicate the extent to which their gold producers or their monetary authorities have made net sales of gold to industrial users, to private hoarders, or to the USSR and its associates . . . the data available . . . suggest that the amount of gold supplied for nonmonetary use and private hoarding was larger in 1951 than in any other postwar year.

". . . it seems certain that the recent decline in the premium price of gold has been due largely to the increased diversion to premium markets of newly mined gold, and, in a few cases, of gold held in official reserves."

The Australian governor's statement said, in part:



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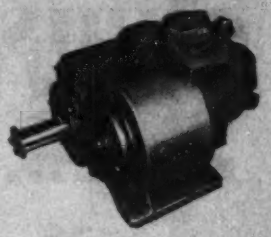

Eimco Geared Air Motors are husky, powerful units built to work on a continuous operating basis with a minimum of attention.

All gearing, shafts and bearings are designed to work under continuous peak loads.

Power units are Eimco 5 cylinder, radial-type, reversible air motors. These motors have a high starting torque and work efficiently on pressures from 40 to 125 p. s. i.

Eimco Geared Units are available in three sizes, conservatively rated at between 7½ to 17 h.p., each with four different speed ratios.

Eimco Geared Air Motors are the only completely safe, completely dependable units.

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This Month in Mining *(Continued)*

". . . It can scarcely be regarded as a permanent solution of the problem to substitute for a market in which there was a small turnover at high prices one with a much larger turnover and, therefore, an increasing diversion of gold into private hoards, even if the price approximates more closely to the official price.

". . . Despite . . . jostling for a fair share of an inadequate stock of gold, the outlook is that with rising costs the annual production will also, before long, begin to decline.

". . . If the aim of policy is to compel a stiff dose of deflation, then it is true that in this way the trend (for gold to flow into the U. S.) might be reversed. But it would involve larger sales of goods to the United States, and it is by no means certain that the United States is prepared to increase appreciably her purchases of the goods of other countries. Are *any* of the countries concerned really prepared to face the discipline involved? Are countries outside the United States prepared to accept the necessary deflation? Would it be practicable to expect the United States to make the whole of the required adjustments, perhaps at the expense of seeing some of her domestic industries damaged by an excessive flow of imports? Viewed apart from the realities of the world, deflation might perhaps be a sensible solution, but I suggest that it is a remote and unlikely one in this world . . .

". . . To a limited extent the European Payments Union has taken the place that the Fund was intended to fill. . . . But the resources of the EPU are comparatively small, its membership is restricted, and its future as yet uncertain. There may well be doubts too about the wisdom of seeking a regional solution to a problem which is much wider. The EPU does not provide the solution . . . "

(Robert Triffin, Yale University professor of economics, wrote, in a letter Sept. 25 to the *New York Times*: "The achievements of EPU in the last two years, even though far from ideal, constitute an undeniable progress over the unmitigated bilateralism which previously resulted from the Fund's passivity toward these . . . problems.")

"We come then," the Australian governor said, "to the solution we are proposing . . . an increase in the price of gold. It is not an ideal solution. It is not even a complete solution. But the perfect was ever the enemy of the good . . . we must not reject an imperfect and incomplete solution in the vain hope that we may some day attain the ideal."

He said the alternative, "to keep the price of gold fixed as prices rise," would result in "increasingly inadequate (supplies of gold) to sustain a healthy flow of international trade. We must expect the fences built against imports to be raised ever higher as the shortage of gold becomes more acute . . . "

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DOW (BEAR BRAND) XANTHATES

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an effective combination to improve your flotation!

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DOW XANTHATES—For greatest efficiency and economy in the separation of sulfide minerals, Dow Xanthates are unexcelled! These uniform quality collector reagents give greater concentration and maximum recovery. To allow extreme selectivity, Dow offers a wide range of Xanthates—all possessing good collector power. For more detailed information on Dow Xanthates and what they will do for you, write to Dept. OC 29A.

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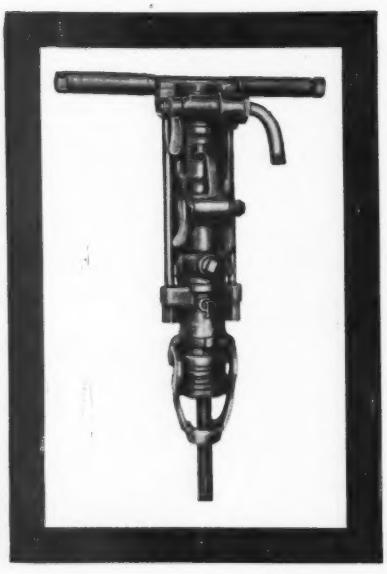

For general purpose mining the CP AIRLEG provides a rigid, well-balanced support for the drill and effectually absorbs all recoil.

A CP ratchet throttle — an exclusive feature — maintains balanced feed-leg pressure and keeps the bit in constant contact with the rock. This fine balance of feed pressure prevents "slapping," and minimizes the danger of fracturing tungsten-carbide bits.

CP AIRLEGS are available in 1⅞" and 2⅛" feed cylinder diameters, and with 36" and 48" feed travel. They are ideal for use with CP Sinkers, particularly the general utility 45 lb. class CP-32, and the 55 lb. class CP-59.

For faster tunnel driving

The CP-50N DRIFTER, combining strong rotation and fast hitting action with just the right foot-pound blow for maximum penetration with tungsten-carbide bits, is ideal for use with the CP Air Actuated G-600 DRILL JUMBO.

Rail-mounted, for standard track gauges, the G-600 is furnished in single and multi-boom units. Booms are quickly adjustable to any drilling position.

mining

For stoping or raising

The well-balanced, medium weight, CP-34 STOPER has just the right piston speed, foot-pound blow, rotating speed and feed-leg pressure to insure long service from tungsten-carbide bits.

A special feature is a ratchet-type twist throttle, on the holding handle, for exceptionally fine control of feed-leg pressure. A button on the handle provides instant pressure release should the bit stick.

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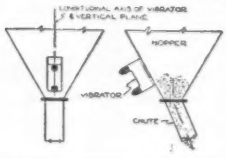
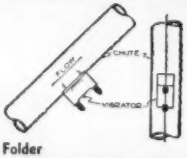


Now, Syntron presents a complete line of Semi-Noiseless Electric Vibrators for use in installations located close to workers where noise is a major factor.

They operate the same as standard Syntron Vibrators—assure a smooth, controlled flow of material—prevent loss of costly time due to material coming 'short' on dependent operations and prevent loss of materials due to 'surges'. New 'cushion' action provides a sharp reduction in the operating noise.



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SYNTRON COMPANY
510 LEXINGTON AVE. HOMER CITY, PA.

Uranium Recovered From Phosphate Rock

BY-PRODUCT RECOVERY of uranium from phosphate rock is here. Blockson Chemical Co. recently began production at its plant at Joliet, Ill., where commercial output is being obtained for the first time. Sodium phosphate chemicals and concentrated commercial fertilizers are the chief products. The uranium is distributed under AEC control.

International Minerals & Chemical's annual statement said delays in delivery of materials and equipment had retarded construction of its Bonnie plant in Florida but forecast production in early 1953. The plant's uranium output will be a product of defluorinated feed phosphates and multiple superphosphate production. Others building full-scale recovery units are Virginia-Carolina Chemical, whose site is near Mulberry, Fla., and Texas City Chemicals, building at Texas City, Tex.

530 Days Allotted To Drain Osceola

CALUMET & HECLA ENGINEERS estimated 530 days will be required to drain the Osceola mine in Houghton County, Mich., of 7-billion gal. of highly corrosive water, necessitating use of special pumps and pump columns.

Twenty-three pumps, costing as much as $24,000 each, will be suspended on cables and lowered into the receding water, which will be pumped down to the 3,600-ft. level about 2,200 ft. below the surface. Rehabilitation, including re-timbering, will be carried on simultaneously.

Company cost is expected to reach $6-million. DMPA has guaranteed a 25¼¢-a-lb. floor price for up to 53,000 short tons of refined copper to be delivered at a rate of 7,125 tons a year until June 30, 1962.

Dean Process Tested In Riverton Project

THE DEAN PROCESS will be tested on a semi-commercial basis for the first time by Manganese Chemicals Corp.'s program for recovery from low-grade manganiferous ores of Minnesota's Cuyuna Range 2.625-million long ton units of manganese concentrates containing not less than 0% manganese. It is hoped this method, known also as the ammonium carbamate process, will facilitate commercial recovery from other domestic low-grade ores as well.

Manganese Chemicals will spend about $2-million to build a plant near Riverton, Minn., capable of treating 200 tons of ore per day and having annual capacity to produce 456,000 long ton units, equal to 10.2144-million

lb., of concentrates. The government will advance $1.5-million, to be repaid with interest, and underwrite the market for all Riverton output initially at $2.35 per unit (compared to $2.30 currently fixed for 48% ores and concentrates). Guaranteed price, subject to review after six months' operation, is expected to decline with time.

Fluorspar Output Upped 50,000 Tons

A NEW FLOTATION MILL will be built in Wilmington, Del., by St. Lawrence Fluorspar to increase supply of acid-grade fluorspar 50,000 tons a year. Inducement is a $1.25-million government loan and contract covering a four-year period or until the new facilities have produced 150,000 short tons.

St. Lawrence Corp. of Newfoundland, affiliate of the Wilmington concern, will build a Sink and Float plant in Newfoundland, where the ore will be mined and reduced to low-grade concentrates. Acid grade will be obtained in Wilmington. DMPA Administrator Jess Larson said total output is earmarked for defense and other essential industrial uses.

DMPA previously negotiated an agreement committing Ozark-Mahoning Co., Tulsa, Okla., to increase fluorspar output by 20,000 tons a year.

42,600-Ton Cryolite Output Planned

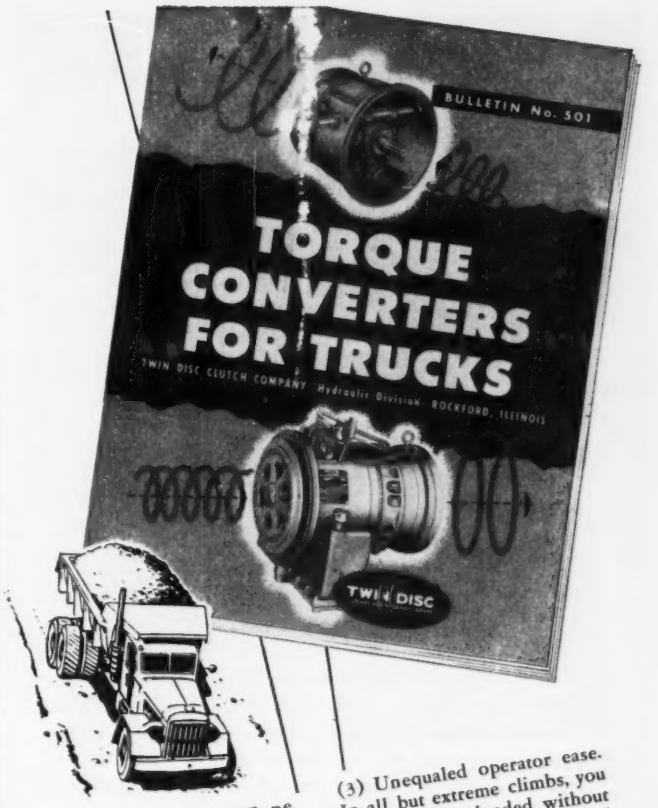
ALUMINUM ORE CO., which heretofore produced synthetic cryolite only for its parent, Alcoa, will expand facilities at East St. Louis, Ill., to increase output 11,000 tons a year and sell 42,600 short tons to the government by the end of 1956. Base price of 13.9¢ a lb. has been guaranteed. DPA requested the arrangement.

Concurrently, DMPA announced signing of a contract to increase U. S. supply of natural cryolite, found only in Greenland, by 13,700 tons.

Du Pont To Expand Titanium Capacity

E. I. DU PONT DE NEMOURS will produce an additional 13,500 short tons of titanium sponge over a five-year period according to terms of an agreement with DMPA, the government agency's Administrator Jess Larson announced recently. This is equivalent to three times the company's present capacity.

Du Pont will expand Delaware facilities at Newport and Edge Moor with a $14.7-million government loan. A fast write-off covering 90% of the investment is pending NPA approval. If saleable sponge is produced at the expanded plants, the money will be repaid with interest, but Larson conceded the additional facilities may become obsolescent during the five-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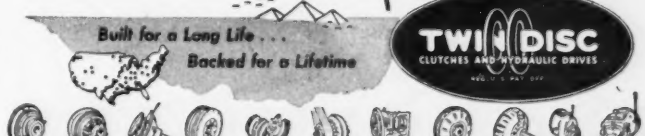
TWIN DISC CLUTCH COMPANY Hydraulic Division ROCKFORD, ILLINOIS
TWIN DISC

Twin Disc Truck-Type Torque Converters are helping set new standards for operator ease, trip time and low maintenance in open pit mining. In mine after mine where loads are big and hauls steep, trucks equipped with Twin Disc's Converters have increased operating efficiency, cut hauling costs through triple advantages. Only Twin Disc Truck-Type Hydraulic Torque Converters provide these exclusive advantages: (1) Highest (up to 6-to-1) torque multiplication, (2) Torque Converter braking, (3) Unequaled operator ease. In all but extreme climbs, you come up fully loaded without gear shifting, and descend empty without using the brake pedal!

Write for newest Truck-Type Torque Converter Bulletin (No. 501) to see which of Twin Disc's two converters—Model CF for short, steep hauls or Model DF (with direct drive) for longer hauls with intermittent climbing and descending—fits your requirements. Or contact your nearest Twin Disc Factory Branch.



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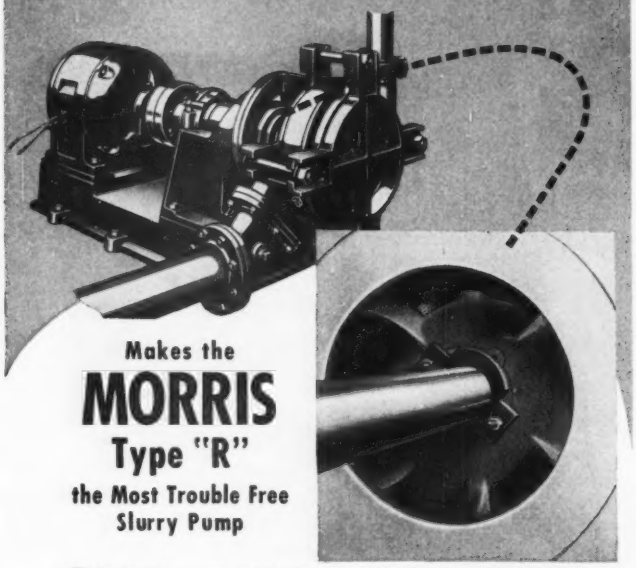

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MORRIS Centrifugal Pumps

year period as a result of technological improvement. In that case, he said, the government would take possession and waive repayment, less depreciation and amortization.

The deal is similar to one providing that Titanium Metals Corporation of America produce 18,000 tons of titanium sponge over a five-year period.

NEWS BRIEFS

Chile reportedly has exempted mining machinery from import duties, except that imported by iron ore producers, copper producers whose output exceeds 20,000 tons a year, and participants in the Nitrate and Iodine Sales Corp. system.

•

DPA raised its sights to a target 40-million lb. a year of tungsten contained in concentrates and ores by 1954. The figure is 6-million lb. more than the goal announced Aug. 1 and compares to 9-million lb. acquired in 1950 and estimated 7.6-million lb. domestic output in the current year.

•

Societe des Bauxites du Midi launched its first shipload of bauxite for Canada under an agreement whereby Aluminium Company of Canada will be reimbursed in bauxite for investments. The mineral is mined from an open-cast deposit by a joint American-French-Canadian firm. Projected output is 50,000 tons this year, 300,000 in 1953.

•

London de-controlled lead, lead alloys, lead scrap and residues, remelted zinc, zinc alloys, zinc scrap and residues, copper scrap and residues, and copper-alloy scrap and residues effective Oct. 1.

•

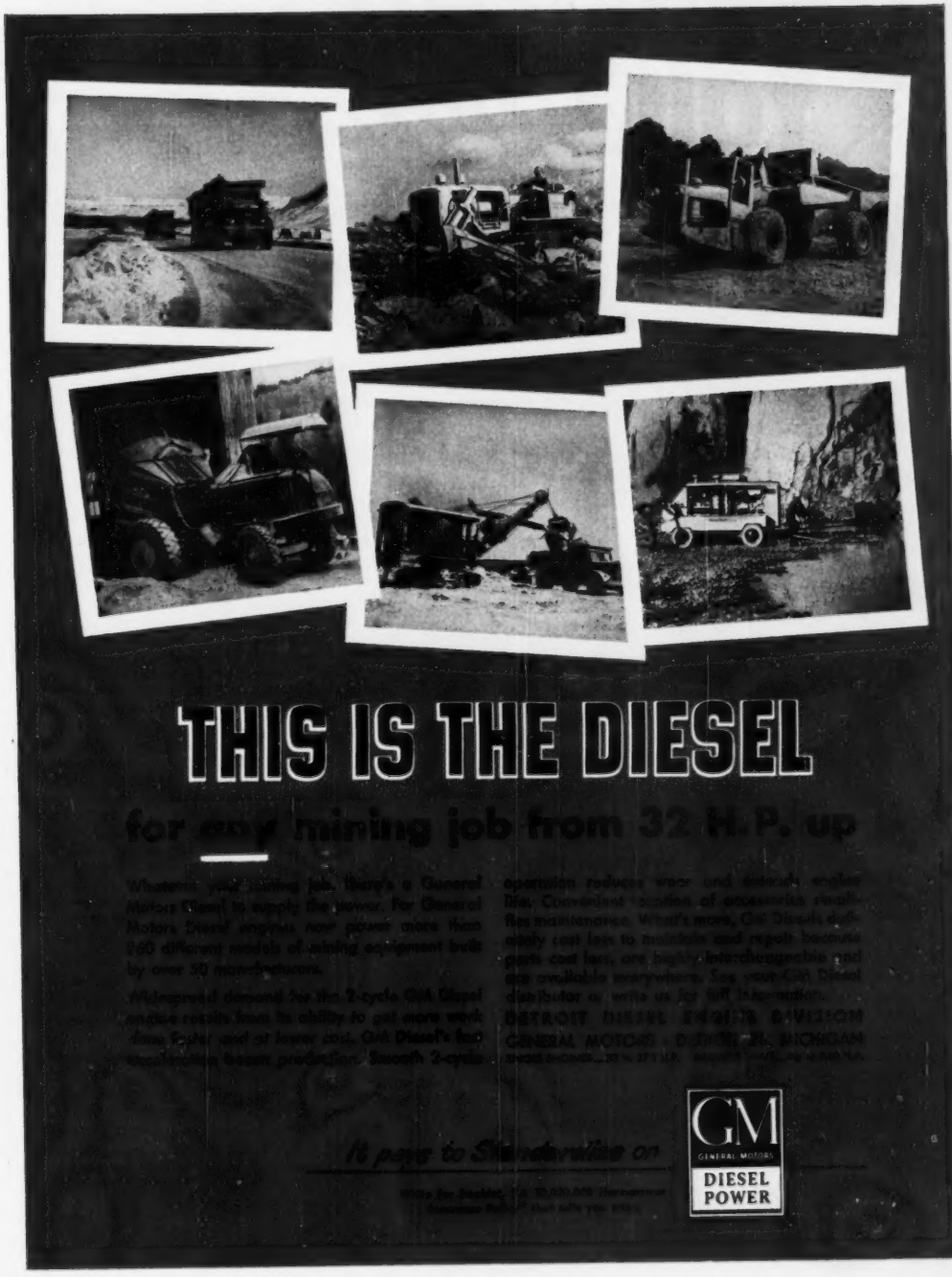
Apex Smelting Co., Chicago, expects to begin construction this winter of an aluminum plant at Springfield, Ore., to reduce the metal from an abundance of aluminum silicate clay found in the Cottage Grove, Ore., area. The operation will carry a new process from the experimental to the commercial stage.

•

Garfield Chemical & Manufacturing, jointly owned by AS&R and Kennecott, and Stauffer Chemical have formed Western Phosphate, Inc., to operate their projected $9.85-million superphosphate fertilizer plant at Garfield, Utah. Completion date is in 1953.

•

First Annual Southwest Mineral Conference, jointly sponsored by New Mexico Mining Association and Southwest International Mining Association, is on in Albuquerque Nov. 6, 7, and 8.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1192

This Month in Mining *(Continued)*

Newlund Mines, one of the few underground gold-mining operations in Ontario, was debating whether to shut down until gold brings a better price. This trend has gone into reverse in South Africa (see Page 170) where the value of uranium by-product is making gold-mining once again a highly profitable enterprise.

•

South African metallurgists have come up with a process for recovery of uranium oxide from gold ores, said to be as portentious as the McArthur cyanide process that saved the gold-mining industry from extinction at the turn of the century. Details are secret.

•

International Minerals & Chemical Corp., Chicago, is in process of acquiring Consolidated Feldspar Corp. by exchanging of shares, according to Louis Ware, International's president. When the exchange has been completed, Consolidated Feldspar will be merged into International as part of the latter's Industrial Minerals Division, which it organized recently upon acquisition of Eastern Clay Products. International is growing rapidly.

•

U. S. Tin plans to up capacity from 10 to 200 tons of ore at its Lost River, Alaska, mill, permitting daily output of concentrates containing 5 tons of tin and giving impetus to construction of a $250,000 tin smelter that has reached only the talking stage. Proposed site is Seattle. At present, concentrate is shipped to New York for tungsten extraction, then to Texas City for tin recovery.

•

Look for some AEC-Bureau of Land Management compromise that will cut away red tape for uranium prospectors. Conflict is cropping up on the uranium-rich Colorado Plateau between the prospectors and holders of gas and oil leases. An AEC official said oil and gas leases don't convey rights to other minerals and that some way must be found to relieve uranium prospectors of the requirement they obtain specific leases.

IN ALASKA

★**Imperial Jade Co.,** which has developed a low-cost cutting process, is doing extensive work at Jade Mountain near Kotzebue in the Arctic Circle.

★It has been reported from Fairbanks that **Anker Hoidahl,** engaged in mining in the Firth River area for the past five years, has discovered a promising tungsten deposit.

★**Test drillings of the iron ore deposit at Klukwan** in southeastern Alaska are underway, according to George

Big Red TD 24 Pioneers New Frontier

MINING A POWERHOUSE. Hardrock mining methods are being used in blasting the world's largest hydro-electric powerhouse out of solid rock, with the International TD-24 providing the brute strength on the mucking-out operation.

59 "Big Red" International TD-24 crawler tractors spearhead largest integrated engineering program in history for Aluminum Company of Canada, Ltd., on Project British Columbia

A fleet of 59 hard-hitting International TD-24s is blazing a new frontier across 5,000 square miles of wilderness in British Columbia.

Here are some of the jobs the project includes, in an area that even now hasn't been completely mapped:

- **building the largest sloping clay core dam in the world**
- **driving a subway-size tunnel ten miles through a mountain**
- **blasting out an eight-story powerhouse two blocks long inside solid rock**
- **erecting a transmission line fifty miles long over a jagged mountain range**
- **raising the world's largest aluminum smelter and a new port city at Kitimat where 50,000 people may eventually live and work.**

Inside the powerhouse cavern itself—a structure to be eight stories high and two blocks long when completed—a Big Red TD-24 is mucking the shot rock as the cavern is blasted from the top down.

In fact, all over the project, veteran mining and construction workers find that Internationals provide the muscle behind each engineering feat that keeps these far-flung operations going ahead like clockwork.

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Alaska *(Continued)*

Sundborg, who said 5-billion tons of magnetite ore has been surveyed. There are deposits also of nickel and cobalt near Kluane Lake and manganese and tungsten at Watson Lake.

★DMEA has granted **Zenda Mining Co.** an additional loan of $60,000 for work at its Teller tin property, according to Norman C. Stines, company engineer. Jack Thiessen is superintendent.

IN THE U. S.

ARIZONA

★Arizona is headed into a **mining boom** that will be the equivalent of World War II development. Companies will pour $200 million into expansion of major copper developments in the next two years.

The Department of Minerals and Resources reports that expansion will include the Copper Cities development near Miami, the San Manuel near Mammoth, Lavender Pit at Bisbee, Silver Bell near Tucson, and Bagdad Copper Corp. at Bagdad.

Frank J. Tuck, statistical engineer for the department, said the program will mean:

1. A 32½% increase in total copper tonnage from the state's mines.
2. A potential increase of $65,640,000 in value of the metal products.
3. A possible total annual payroll increase of $16,898,600 attributable to 3,800 new jobs.

Investments and production capacities will be:

Copper Cities — owned by Miami Copper Co., to produce 15-million lb. of copper annually starting late in 1953. Development will cost $15-million.

San Manuel—owned by Magma Copper Corp., $125-million. Will produce 140-million lb. annually beginning in 1955.

Lavender Pit—$25-million, 76-million lb. annually beginning late in 1954. Owned by Phelps Dodge.

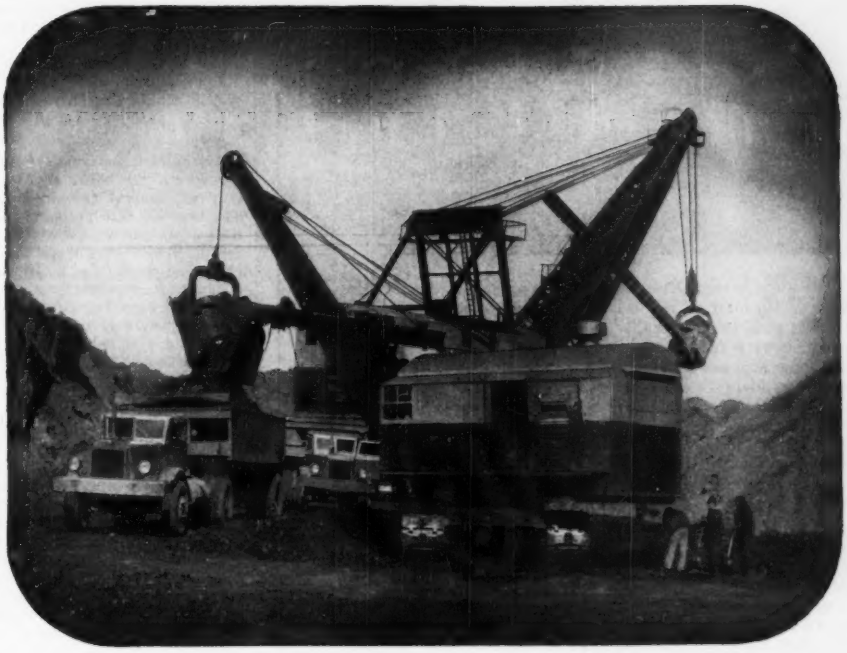
Silver Bell—$17-million, 36-million lb. annually by 1955. Owned by American Smelting and Refining.

Bagdad Copper Corp.—$18-million, 20-million lb. annually by 1954 in addition to present production.

The 832-million lb. now produced by the state each year will be increased by 317-million lb., Tuck reported. This is a hike of 38%. But since the present production of Castle Dome will be lost, the new development being a replacement for the depleting orebody, net gain will be 272-million lb., or 32½%.

Ernest H. Dickey, manager of the Bagdad properties, said value of ore extracted from mines in the Eureka district will be increased from $6.5-million during the past year to $23-

WIRE ROPE



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YUBA manufactures Revolving Screens and ARS* Perforated Plates which meet all requirements of finer screening for rare minerals such as monazite, scheelite, garnet and zircon. Illustrated above is 12-year-old YUBA Dredge #142, equipped with these new screens, dredging monazite at Cascade, Idaho, for owners Idaho-Canadian Dredging Company. It has 6 cu. ft. buckets and a portable pontoon hull so that moving to new properties is relatively easy.

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YUBA #107, 3 cu. ft. buckets owned by H. & H. Mines, Inc. Over 15 years old, with portable pontoon hull, it was moved from its original property and re-equipped by owners for dredging scheelite at Henderson Creek, Montana.

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Arizona *(Continued)*

million by 1954. Of this, $12-million will be in copper, $1-million in zinc, and $10-million in tungsten ores.

The district payroll will be increased from $155,000 a month to $375,000 by 1954, Dickey said.

Two mines and their nearby mills are involved. One is at Bagdad, where copper, zinc, and a small amount of gold is mined. The other is at Hillside, where an old lead and zinc mine has been reopened.

The mines account for the largest single payroll in Yavapai County, which county has assisted development by pushing through new access roads.

★Arizona's Supreme Court has thrown off the ballot a proposed 1% **levy on mineral resources depletion.** The new tax was proposed in an initiative petition with revenue planned for a public employees' retirement fund. The court ruled petitions lacked adequate valid signatures. The new tax would have been in addition to a 1% production levy already in force on mining, plus sales and other taxes.

Opposition to the initiative proposal was spearheaded by Arizona Sand and Rock of Phoenix, upon whose protest the court acted. The new tax would have applied to all mined or quarried products.

Charles Willis, secretary of the Arizona Small Mine Operators Association, said the industry in Arizona is carrying a heavier tax load than are other Rocky Mountain states. He said mines in the state were taxed five times as high as is livestock and 70 times more than is agriculture, based on value of production. He said venture capital is discouraged.

★**Present mineral exploration** work in Arizona covers eight projects costing $600,000, including searches for lead, zinc, asbestos, manganese, and copper.

★By way of correction, A. W. Enders informs us his mill is in Globe, not at his mine site, and that it is not now inactive, as implied by an item in the September issue. "I . . . never," he writes, "Have milled ore on a custom basis. My mill . . . has been operating continuously since 1945. . . . At no time do I do any milling for any other asbestos producer."

CALIFORNIA

★Siskon Corp. is completing erection of 25 pre-fabricated buildings at **Siskon gold mine** 20 mi. north of Somes Bar preparatory to installation of a ball mill with 100-ton-per-day capacity. Veins in surface workings vary in width from 20 to 100 ft. and will be mined by open-pit methods.

★In the **Rising Hope mine,** Placerville, Superintendent Frank Pike says enough gold ore is exposed to war-

rant installation of a large mill. The property embraces 217 acres of patented ground on Mother Lode and was reopened about a year ago.

★A 6-mi. access road has been completed to the **Black Eagle gold mine,** southeast of Independence, optioned from James Wightman and Associates by U. S. Tungsten Corp. Property is reported to contain milling-grade ore, and construction of a small mill is planned. Wightman and Associates intend to develop another gold property in the area if U. S. Tungsten acquires the Black Eagle.

★U. S. Tungsten Corp. is reportedly planning installation of a concentrator with a capacity of 200 tons of ore a day at the **Jumbo tungsten-gold mine,** 14 mi. east of Indepenence. Jumbo is credited with extensive deposits of commercial-grade scheelite, ore occurring in a perpendicular contact about 1400-ft. wide and estimated depth of 200 ft.

★**Blue Ridge Gold Mines** has begun shipment of 20 to 30 tons daily of scheelite from its Hilton Creek property near Bridgeport to the Pine Creek plant of U. S. Vanadium Corp., near Bishop. The company is also rehabilitating the Tiptop tungsten mine, 4 mi. from Hilton Creek, and planning to install hoisting equipment. Both Hilton Creek and Tiptop are credited with large deposits of commercial-grade scheelite. An orebody 14 ft. wide is mined at Hilton Creek, and Tiptop is said to contain three wide veins.

★Diamond drilling will begin soon at tungsten deposits on the upper Rubicon River, 11 mi. west of Lake Tahoe, controlled by **Rubicon Mining Co.** The company completed a 4 to 5 mi. trail to the property from Big Meadows and plans to install mining machinery. Installation of a concentration plant with an initial capacity of 100 tons daily will be undertaken this year if weather conditions permit. Preliminary exploration indicates the mineral zone extends about 3 mi. from the river to Buck Meadow, one vein 3-ft. wide carrying ore assaying 8% tungsten. Richer scheelite, it is claimed, has been found on some of the other claims.

COLORADO

★**Golden Cycle's Ajax mine** at Cripple Creek has hit good ore on the 3100-ft. level in the drive along the Bobtail vein. For the last five rounds grab samples have been going better than $35 in gold per ton. Streak samples go way up into the pictures. The vein is approximately 3-ft. wide. This good ore on the bottom level seems to indicate rich ore at depth. The day may not be too far away when the shaft will be sunk a few hundred feet deeper.

★Near Monte Vista, the **Villa Grove turquoise mines,** for some time shut

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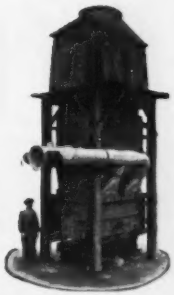

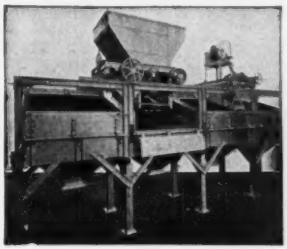

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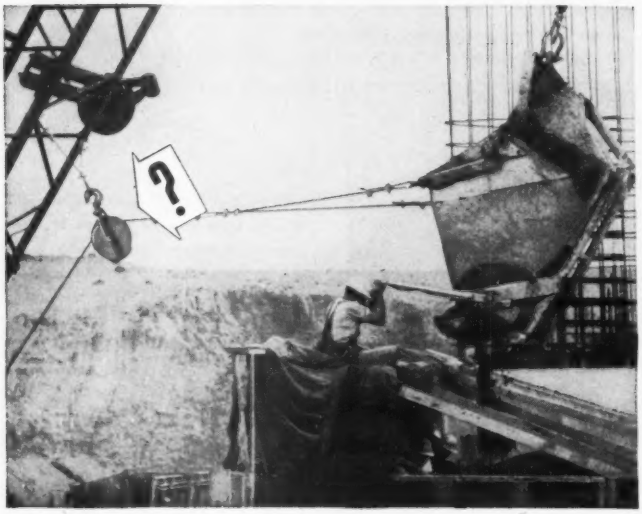

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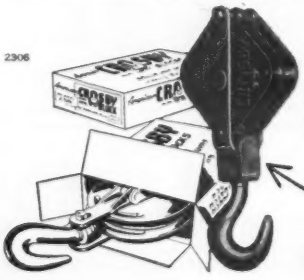

American CROSBY

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WIRE ROPE BLOCKS

Colorado *(Continued)*

down, have been re-opened by a new owner, M. Winfield.

★**Uravan mill,** owned and operated by United States Vanadium Co., has been doubled in capacity and is now the largest uranium ore-processing plant on the Colorado Plateau. For the past year, the company has been installing a new process for treatment of high-lime carnotite ores. It is believed to be the most efficient yet developed for recovery of both uranium and vanadium, and it should mean a considerable expansion of mining activity on the Plateau.

★Colorado Plateau is now said to be **the second largest source of uranium** in the world. It is estimated that almost 5,000 people are taking part in exploration, mining, and milling and that expenditures are more than $30-million a year. It is estimated that the government employs about 500 people, including geologists and mining engineers of the AEC Exploration Branch, as well as those of USGS. Over 1000 people are in mining. Drilling operations account for about 250 more. Another 150 people are engaged in trucking the ore and supplies to and from the mines and mills. There are over 1,000 mill employees, and the rest are largely construction workers.

★**Grace Greenwood mine** near the E. Porter Gold King at Cripple Creek will be reopened, C. H. Carlton, mine manager for Golden Cycle Corp., said. A compressor and hoist will soon be installed and surface buildings repaired and enlarged. The Grace Greenwood is owned by LeClair Mines. Carlton said the mining firm plans to sink the shaft, now about 165 ft., an additional 100 ft. to cut a series of rich flats. In spite of a shallow shaft, the mine produces well.

★H. C. F. Prommel told the Denver Mining Club that 50% lead ore with **50 oz. of silver** can be picked up on Mosquito Range. Some properties are being picked up and held for future operation; others are in a revamping stage and ready to produce.

IDAHO

★**Sullivan Mining Co.** has commenced construction of a sulphuric acid plant capable of producing between 250 and 300 tons of acid daily on a site adjoining its electrolytic zinc plant west of Kellogg. The plant will convert sulphur dioxide produced in the roasting process at the zinc plant to sulphur trioxide for acid by the Monsanto process. Zinc plant roasters are being changed to produce a stronger sulphur gas. The company has been granted rapid tax amortization on $4,350,000 of the cost.

★**Mascot Mines** is opening a new deep level, the No. 10, at the Little Pittsburg property in the Pine Creek area of the Coeur d'Alene mining district.

A gravel pit owner reports . . .

J & L JALLOY

"HAD 'EM SKUN A MILE"

At Left—Walter Stevens holds up J&L Jalloy cutting edge which lasted 2½ years before replacement. Only ⅛" thinner than when new.

Above—It takes tough steel to withstand digging material like this!

Above—Walter Stevens rams loader bucket into gravel bank to pick up another load of gravel.

MAINE STEEL INC. uses tough J&L JALLOY to decrease "Downtime" on Hydraulic Loader at H. H. Stevens Co.

We're pretty pleased with the way Mr. Walter Stevens of H. H. Stevens Sand & Gravel, Gorham, Me., feels about J&L Jalloy.

Mr. Stevens is using a "Straight-Line" hydraulic loader, built by Maine Steel Inc., to load trucks with the sand and gravel from his pit. It's tough work. The loader bucket is rammed into the gravel bank at high speed reverse, which means the severest kind of impact and abrasion on the equipment.

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Here's how Jalloy has worked out—

Mr. Stevens reports, the first cutting edge of Jalloy lasted 2½ years—loaded 40,000 cubic yards of sand and gravel.

Mr. Stevens sums it up this way. "*That blade saved me quite a bit of money.*"

And Maine Steel Inc. is pleased with J&L Jalloy too—

P. J. MacDonald, Maine Steel Welding Foreman, reports Jalloy is no trouble at all to weld using a regular coated rod.

Finally, Mr. G. C. Soule, President of Maine Steel, says that HE'LL CONTINUE TO SPECIFY J&L JALLOY FOR ALL CUTTING EDGES.

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Idaho *(Continued)*

A sump and pockets have already been cut on the No. 10 horizon, and only a short crosscut of approximately 150 ft. will be necessary to intersect the vein. The No. 9 level is now in regular production yielding ore averaging from 7½ to 9% combined lead and zinc. Zinc-to-lead ratio is about 1.75 to 1.

Mascot Mines operates the property under a lease agreement with Pine Creek Lead-Zinc Mining Co., in which the Mascot firm owns a controlling interest. Production from the mine by the present operator and its predecessor, Denver Development Co., has totaled 293,209 tons of ore and $5,067,000 in smelter returns.

★**North Fork Mining Co.** has commenced exploration and development of the six-claim Lucky Strike group at the head of Trail gulch in the Beaver mining district of the Coeur-d'Alenes. Present work is being financed with the proceeds of a public offering of company stock. It consists principally of surface trenching and complete geological examination.

★**Sun Valley Lead Silver Mines** has opened a new lower level on its promising vein in the Blue Kitten property in the Warm Springs district of Blaine County. Drift work now in progress on the new level, which is about 100 ft. below the No. 1 level where the vein was first opened, is following several stringers of rich ore in a 6-ft. space.

★Lateral development along the Queens vein in **Silver Star-Queens Mines** property in the Mineral Hill district of Blaine County near Bellevue has been sufficiently encouraging to justify sinking of a winze. Station and hoist facilities for sinking 500 ft. on the dip of the vein from the present 450-ft.-level drift have been prepared. If the development proves successful, the main Rockwell shaft in the adjoining Minnie Moore mine, from which the 450-ft.-level work was done, will be deepened.

★**Idaho-Custer Mines** has completed its new crushing plant and is putting through about 125 tons of ore per day from rehabilitated old workings of the Livingston mine in the Boulder mining district of Custer County. An estimated 100,000 tons of ore has been blocked out in the old mine, above the 2200, main-adit level. Millheads so far have been averaging 10 or 12% combined lead and zinc.

★**Lucky Friday Silver-Lead Mines** has expanded its Coeur d'Alene district holdings westerly by taking a 10-year renewable lease on 100 acres of adjoining Gold Hunter Mines property. Westerly drifting on the main Lucky Friday vein on the mines' deepest level, the 2000, toward the newly acquired ground is now in progress in a full face of good ore. The leased area will be reached in about 450 ft. of drifting. It covers an additional 1500 ft. along the strike of the vein.

MICHIGAN

★**Pickands, Mather & Co.'s** new Peterson mine at Bessemer is expected to become one of the largest producing iron mines in Michigan. Proksch Construction Co. is building surface structures costing about $450,000. Officials estimate development of the mine will cost $20-million. The shaft is down more than 1700 ft., with crews of six to eight men working three shifts.

Mine officials and employees joined in christening ceremonies of the new shaft headframe. A. D. Chisholm, general manager, broke a bottle of champagne over the shaft headframe, probably the first time that a headframe has received this distinction. Officials of Youngstown Sheet & Tube Co., Bethlehem Steel Co., Steel Company of Canada, and Interlake Iron Corp. attended.

The Peterson includes the Puritan, Ironton, Yale, and Colby mines. The Colby yielded the first shipment of iron ore from the Gogebic Range in 1884.

★Eight hundred construction workers are rapidly developing **White Pine Copper mine.** Most of the 100 acres needed has been cleared and leveled. A good start has been made on the 14-mi. railroad extension from Bergland and on three workers' dormitories, a staff dormitory, service building, boiler-house, water treatment plant, 45,000-kw. power station, mine buildings, and a hospital building. Concrete pouring for the 835-ft. portal tunnel is under way. The conveyor tunnel will be approximately 3800 ft. long and on a 10-deg. incline. Some 3,000 ft. of this will be through mine rock, with rock-crushing equipment at the bottom. Daily ore production is planned to be in the neighborhood of 10,500 tons.

★**Calumet and Hecla** reached an agreement with DMPA whereby the company will operate its Allouez No. 3 copper mine without government assistance. Suspension of the assistance, which was a guaranteed price of 29.7¢ a lb., compared to the 24⅝¢ ceiling, is retroactive to last May 1 and will remain in effect until the company exhausts the deposit of newly discovered high-grade ore on which it is based. DMPA Administrator Jess Larson called the discovery "a stroke of good fortune for both the government and the company." The original contract guarantee was signed Jan. 16 last.

★Peter Kiewit & Sons has begun moving dirt on the Fortune Lake open-pit mine contract, which involves 2.5-million cu. yd. of stripping. About 80 ft. of overburden will be removed to uncover 1.5-million tons of open-pit ore. Harold J. Richards, general superintendent for **Pickands, Mather & Co.'s** Michigan mines, said this ore will be mined in the next three years. Additional ore will be mined underground.

★The Foundation Co. of New York has ledged the 15 ft. x 21 ft. Cannon mine shaft of the **Hanna Coal & Ore Co.** at 143 ft. below surface. The shaft was sunk under compressed-air pressure with crews working in 45-minute relays.

★The lands division of the Michigan Conservation Department has received an application to lease 1,080 acres in the Baraga state forest for **copper exploration.** The last mining of copper in the area was in 1921.

★About 109 gondola cars of iron ore are leaving the **Iron River district** every day for all-rail shipment to furnaces. The C.&N.W. is averaging 85 cars per day, bound for Weirton Steel Co. at Weirton, W. Va., and the Milwaukee road is hauling 24 a day from the Wauseca mine to Steubenville, Ohio.

MINNESOTA

★Two new open-pit producers on the Cuyuna Range will contribute to 1952 shipments. Rabbit Lake mine at Cuyuna, operated by **Pickands, Mather & Co.,** is in the east part of what was Rabbit Lake before it was pumped out. The deposit contains an estimated 7,152,402 tons.

Manuel mine at Crosby, with an undetermined tonnage, is a **Zontelli**

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Minnesota *(Continued)*

Brothers property. With the washing plant completed, the mine will enter the shipping list soon. Zontelli Brothers also has the Virginia mine on the Cuyuna Range and has recently leased the Gorman pit at Randall, which the firm stripped under contract for the Pacific Isle Mining Co. Pacific Isle shipped 34,300 tons from the Gorman in 1951.

★The Office of Price Stabilization granted a 75¢ per ton increase in the **ceiling price of merchant ore** in Lake Superior district. New basic ceilings apply to ore delivered on and after July 26 last. They are: Mesabi Range non-bessemer, $9.05; Mesabi Range bessemer, $9.20; Old range non-bessemer, $9.30; Old range bessemer, $9.45; high phosphorus, $9.05. Cleveland Cliffs Iron Co. has been billing customers at the new ceiling.

★Allis-Chalmers Manufacturing Co. is building for **Reserve Mining Company's** taconite plant at Beaver Bay a giant crusher that will handle 3500 tons of taconite per hour. The crusher will weigh about 550 tons, will have a 5-ft. receiving opening, a 9-ft., 1-in.-maximum-diameter crushing cone and a 27-ft.-long, 100-ton main shaft. Maximum diameter will be 4½ ft. The crusher will be driven by two 500-hp. motors and require more than two years to build.

★**Canadian National Railways** will begin work this fall on a 600-ft. extension to its iron-ore loading dock at Port Arthur, Ont. The addition that will double the dock's length and capacity (now 30,000 tons) is expected to be completed for the 1955 season.

★An extension is being built on the beneficiation laboratory at the **M. A. Hanna Co.'s** Patrick mine at Cooley. The finished building will be 30 ft. by 45 ft. At the company's Buckeye mine, both stripping and ore-washing are being carried on 20 shifts per week. The Morton dragline-conveyor system is operating 21 shifts per week. Foundations have been laid at the Morton for the new inclined skip hoist. New equipment for the proposed ore-handling system is arriving regularly.

★The Whiteside mine of **Snyder Mining Co.**, operated as an underground mine from 1911 to 1915 and with total shipments of 776,225 tons, has been stripped. It has again become a producer, now as an open-pit, shovel-truck operation. Estimated as available is 6,120,954 tons, so it appears the mine's best years are still to come.

★**M. A. Hanna Co.** mines on the Cuyuna Range are operating on a seven-day-per-week schedule. Stripping is being continued at the Mallen, a new mine, while the 7-W dragline is loading surface material onto the conveyor system at the South Alstead.

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MONTANA

★**Caledonia Silver-Lead Mining Co.** of Kellogg has taken a long-term option on more than 1000 acres, including six old lode gold mines and one gold placer in the Judith basin of Fergus County, near Lewistown. The mines, all of which were old producers, include the Kendall, Barnes-King, North Mocassin, Mule Shoe, Santiago, and Horseshoe. The area was in production until closed by the gold-mine-closing order of World War II, but resumption of operations is not planned until an expected increase in the price of gold materializes, officials said. The properties are equipped with a 100-ton cyanide mill in good condition.

★A three-judge federal court, permanently **enjoined the Interstate Commerce Commission** from enforcing an order raising intrastate freight rates by 8%.

NEVADA

★Development work is being pushed ahead rapidly in the **Tungsten Lead Co.** property 42 mi. southwest of Winnemucca. Deepening of a 45-ft. shaft is in progress, and a south hill drift has been extended more than 100 ft.

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Nevada *(Continued)*

On the north section of the property an old prospector's tunnel is being extended south along the vein. Excellent assay values are being realized from all operations. The mine is being operated by Santa Rosa, Calif., interests who took over the property in May. M. E. Price, Denver geologist and engineer, is superintendent.

★**The Getchell Co.** mill at Redhouse is operating to full capacity treating tungsten ores by straight flotation process. Percentage of recovery is high, and a large amount of custom ores is being treated in addition to the ore produced from the Getchell properties. The mill, formerly used for recovery of gold values, is now one of Nevada's largest producers of tungsten concentrates.

★**Bristol Silver mine** in the Jack Rabbit district has 18 men at work producing considerable tonnages of lead, zinc, and silver ores. They are hoisting ore and waste material and drifting at the bottom of a 1200-ft. winze. Don Werner is in charge of operations, and J. H. Buehler is head of the company.

Processing of approximately 500 tons of ore daily from open-pit workings is being carried on to determine outline of the tungsten orebodies. A mill has been constructed on the property, but present operations are confined to treatment of tailings, from which zinc and fluorspar concentrates are recovered.

★**Production has started at the new 1,350-ton manganese mill at Manganese Inc. in Clark County.** Concentrates are calcined and nodulized in big kilns. The mill is the only one of its kind, and its operation has attracted wide notice. The process was worked out by Manganese Inc., under H. S. West, president, and Southwest Engineering Co. of Los Angeles. The mill is situated near the old Three Kids mine, where 280,000 tons of 22% manganese dioxide ore has been stockpiled by another company. There is 5-million tons of ore still unmined, according to Bureau of Mines estimates.

★**Mineral Material Co., Dodge Construction Co., the American Ore Co., and Nevada Iron Ore. Corp.** are mining iron ore from the Lovelock fields in Pershing County but report their operations are hampered by a shortage of railroad cars. When cars are available, the four shippers will normally load 40 to 50 daily. Some of the ore will run as high as 70% iron.

★**The new Kaiser fluorspar mill** at Fallon has started operating after three months of construction. It will process ore from the old Vet Baxter fluorspar mine, where 17 Kaiser employees have been doing development work for the last few months. Situated on the Carson River, 1 mi. east of Fallon and along Southern Pacific tracks, the new mill will be operated by the flotation process after crushing and grinding. Jay Shoemaker is superintendent of operations, and 15 men are employed in the mill.

★The new silver and gold strike at Calumet and Hecla's Tonopah property is developing well, and the vein is much longer and richer than was at first expected. Recent assays average $45 or more per ton for width of the vein. If the vein continues to show sufficient promise after continued raising and sinking work, it is anticipated a mill will be erected. Property is being operated under joint lease by **Homestake Mining Co., San Francisco, and Summit King Mines.** Percy Dobson is superintendent.

★At Basic Magnesium's plant at Henderson, **Titanium Metals of America** has expanded lease holdings to include Unit 10 of the BMI plant, facilities previously leased by Pioche Manganese Inc. The unit will be converted immediately to titanium production.

NEW MEXICO

★**The State Inspector of Mines' 40th annual report** valued total mineral output for the year ended June 30 at $99,648,584, up $9,926,628 from the year previous and a new state record.

There were five fatal accidents, one

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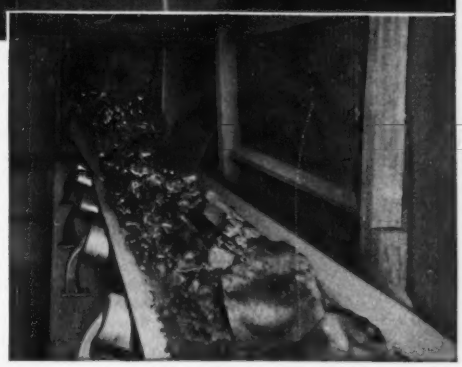

View of loading point at top of tipple.

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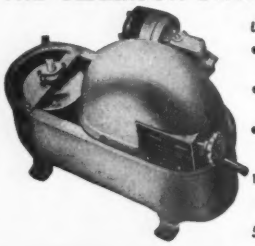

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New Mexico (*Continued*)

per 3,100,685 man-hours of exposure, and 638 non-fatal accidents resulting in lost time, one per 24,223 man-hours of exposure. Though the figure in the latter category represents an increase of 168, loss of time was less than in the year previous.

Most profusely produced mineral was potash, output amounting to 7,017,814 tons worth $36,117,201, and with the increment to be supplied by Southwest Potash Corp. (expected to be in production before this issue goes to press) production in the current report year is expected to exceed 10-million tons. Duval Sulphur and Potash Co., which went into production in March, is credited with a large part of last year's big increase that pushed potash out in front of copper, traditionally the state's production leader.

Copper output was 73,974 tons valued at $35,767,417, down 1,253 tons.

Perlite and uranium production increases are also forecast on the basis of operations begun last February at No Agua, Taos County, by Schundler Perlite Co. and construction now under way near Bluewater, on the part of Anaconda Copper, of a uranium-processing mill. Anaconda's project is scheduled for completion by June 30.

Output of sand, gravel, and clay totaled $1,277,451 in value, $228,832 below that of the year previous. Other figures included in the report were:

	Tonnage 1951-52	Tonnage 1950-51	Value 1951-52
Pumice	274,121	418,044	$694,736
Perlite	68,345	46,566	298,584
Zinc	50,629	44,655	13,270,914
Lead	13,205	7,331	4,707,499
Total Non Metallic			39,421,926
Total Metallic			55,368,655

Number of metal-mine employees increased by 384 to 3,593, including 1,276 in mills, 900 underground, 1,194 on the surface, and 223 miscellaneous. Nonmetallic-mine employees, up 414, numbered 3,530. Sand, gravel, and clay producers employed 320.

The state mine inspector during the year issued 47 certificates and permits related to mining activities.

★**Zuni Milling Co.**, a Shattuck-Denn fluorspar operation in Valencia County near Grants, is prospecting for uranium. Extensive deposits have been uncovered in the area by both Santa Fe Railroad and Anaconda Copper Corp. Anaconda plans to build a mill to process uranium at Prewitt, west of Grants.

NORTH CAROLINA

★The Defense Production Administration has recently granted a certificate of necessity enabling **Tungsten Mining Corp.** to write off, over a period of five years, one-half of $1,110,000 to be spent on an expansion program.

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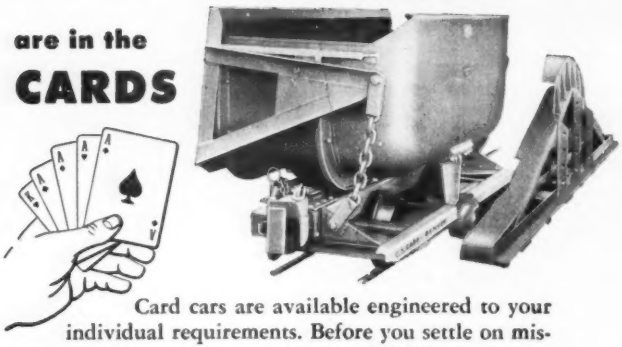

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OHIO

★Armco and Reserve are the names chosen by **Oglebay, Norton and Co.** for two new ships now under construction at The Columbia Transportation Co., an Oglebay, Norton subsidiary. Namesakes are Armco Steel Corp. and Reserve Mining Co.

OREGON

★**Ashland Mining Co.** is using open-pit methods in mining chromite ore at the Shady Cove prospect near Galice in Josephine County. The ore is concentrated at the company's mill near Ashland. A sample of chromite concentrates ran 52.60% chromium oxide and 14.28% iron.

★**At the Mattern tungsten deposit** on the Southern Pacific right-of-way, 1 mi. northwest of Ashland, the Ashland Mining Co. has been mining since February. It is now stockpiling scheelite to be concentrated this winter when weather conditions prevent chrome-mining operations. The ore was formerly concentrated in the company mill and shipped to U. S. Vanadium Co., Bishop, Calif.

TENNESSEE

★TVA's phosphate and classifying operations at its Columbia, Tenn. phosphate branch have been closed for an indefinite period. Mining and other operations will be continued, and unwashed phosphate ore will be used in operations there and at the main Wilson Dam plant.

Reason for the change in procedure is that deposits owned by TVA in the immediate area are mined out, and ore from other mines nearby is not suited to the washing process.

UTAH

★**The Howell Mining Co.** shaft in Utah's Marysvale uranium district is now some 250 ft. down, well below any other workings in the area. Company President Whitmore reported the shaft, in Yellow Canaries properties, has reached a point well below the leached area, and drifting has started on the east-west structure.

★No agreement has been reached between Kennecott and 3,000 Utah division workers who hold membership in the International Union of Mine, Mill and Smelter Workers or with 700 Garfield refinery workers who are members of United Steelworkers.

★University of Utah has announced plans for a **low-cost atomic reactor,** to be built with $50,000 in research grants made available by Kennecott.

The reactor will be designed by Dr. Lyle B. Borst, professor of physics and former head of reactor development at Brookhaven, L. I., New York. It is to be used for research into the properties of metals and for medical studies and investigation of nuclear problems.

Construction is not expected to begin until early next year, when AEC clearance of planning and release of fissionable material are expected.

WASHINGTON

★Four thousand employees of **Kaiser Aluminum & Chemical's** Trentwood and Mead plants received a total of $840,000, representing pay increases averaging about 16¢ an hour retroactive to Jan. 1.

★Five prospects in Stevens and Pend Oreille Counties are being explored by **Grandview Mines, Karl W. Jasper**, president, reported. At the Jim Creek holdings in Pend Oreille County, southwest of Metaline Falls, bulldozing over an extensive surface area has disclosed fair zinc mineralization. At the Currant Creek prospect in Stevens County, surface bulldozing has revealed a large iron capping where diamond drilling is scheduled to begin soon. Diamond drilling is being carried on in ground between the Anderson and Admiral mines. Surface stripping has been carried out at another prospect west of the Anderson mine, where there are promising showings of zinc. Diamond drilling is being carried on at the Plug prospect, near the Farmer mine, where commercial-grade zinc had been revealed by surface stripping.

★**Merikay Mines** has a dozen men doing exploratory work by tunneling and open-cut mining at a beryl deposit north of Chewelah. The beryl occurs in a large pegmatite dike. Arthur Collins, of Chewelah, is managing the operation.

★Testing of the new zinc-lead flotation plant at **the Van Stone mine** in Stevens County was recently scheduled, P. A. Lewis, general superintendent, said. He reported about 25,000 tons of low-grade ore had been stockpiled. Thirty men were working on five levels of the open pit.

WISCONSIN

★**Vinegar Hill Zinc Co.** has completed its 6½-by-13 ft. shaft into the Mulcahy orebody, 3½ mi. southwest of Shullsburg, for a total distance of 217 ft. into the oilrock. Drilling will be done by a double-jib Jumbo. Ore will be loaded by a 12-B Eimco loader, can-hoisted to the surface, and trucked 2 mi. to the Vinegar Hill flotation mill. Estimates indicate 150,000 tons of ore averaging 6.4% zinc and 0.25% lead.

IN CANADA

★Canadian zinc production may again break all previous records in 1952, with possibility that the year's total may exceed 356,000 tons. Records have been established in each of the past two years; the 1950 total having been 310,000 tons and that for 1951 reaching 340,000 tons. Output in the first six months was up 17,000 to 178,786 tons, and it is quite likely that output in the second half will top that by a good margin.

BRITISH COLUMBIA

★The Canadian Federal Government has been asked by the new Social Credit Provincial Government to refuse further **permits for export of iron ore.** Premier W. A. C. Bennett complained the province's iron ore deposits were being "gutted for export" and that British Columbia preferred to treat its own ore. The government's stand is supported by C. D. Hobbs, managing director of Western Canada Steel Co., which plans an integrated steel industry in Vancouver.

★Representatives of **Nippon Steel Tube Co.** were negotiating with **Quatsino Copper-Gold Co.** for a contract to take a million tons of ore from the Vancouver Island property now being developed. C. T. Takajashi & Co., Vancouver, handling the deal, said the contract would provide for shipment of Quatsino ore to the "Big Four" Japanese steel mills starting in 1953. The Japanese mills already have taken 470,000 tons from the Quinsam Lake deposits on Vancouver Island developed by the Argonaut Co. Current Quinsam shipments are at the rate of 50,000 to 60,000 tons a month, with 20,000 going to Baltimore steel mills.

★**Western Canada Steel Co.** plans a $4-million electric furnace, dock and other facilities near the extended rolling mill in South Vancouver. First furnace would have a capacity of 100 tons of iron ore daily, a maximum of five units to be built as the market expands. The company currently produces steel bars, rods, angles, and other shapes from scrap. The new project includes manufacture of structural steel, but not roll plate or sheet steel. Ore would come from Vancouver Island deposits.

★Pend Oreille Mines & Metals Co.'s Canadian subsidiary, **Reeves MacDonald, Ltd.,** is building an underground hoist room at its property at Remac, B. C. This is in preparation for sinking an inclined shaft along the footwall of its main Reeves orebody. Sinking was scheduled to start by the first of this month. Character of the ore has remained the same from the surface down 1,000 ft. to the main haulage level, and it is believed the orebody will carry down another 1,000 ft. When depth is proved, a vertical

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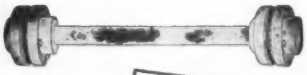

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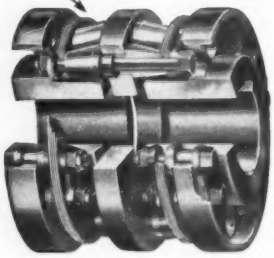

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British Columbia *(Continued)*

working shaft is planned. Proven ore averages about 4% zinc and 1% lead. During the first eight months of 1952, the mill has averaged 27,500 tons per month, compared with an average of 25,000 tons during 1951. The new finer-grinding jaw-crusher being installed may stabilize monthly tonnage at around 30,000 tons. Mining and milling costs are running about $4.50 a ton, against $4.05 a ton in 1951.

★**Canadian Johns-Manville Co.** has been conducting extensive tests on an asbestos deposit in Reeves Twp., about 35 mi. southwest of Timmins and 10 mi. east of Foleyet on the transcontinental line of the C.N. Ry. The deposit is big, but there is considerable doubt as to grade.

☆Indications of new ore farther east than any showings previously encountered in the mine have been secured by **Madsen Red Lake Gold Mines** on the 12th level. Two horizontal drill holes put out for exploratory purposes returned good intersections, one showing 9.2 ft. averaging 0.57 gold per ton, the other 8.9 ft. averaging 0.47 oz. and 5.8 ft. averaging 0.47 oz.

★A large though low-grade lead-zinc-copper orebody has been suggested by surface drilling at the property of **Page-Hardey Mines** located on the main line of the C.P. Ry. about 125 mi. northwest of Sudbury.

★**Gulf Lead Mines** is starting to diamond-drill its eight-claim zinc-lead-silver group in the Onaman River area east of Lake Nipigon in northwestern Ontario. Initial work will consist of a series of cross-section holes to probe the strongest of a number of anomalies outlined by dip-needle survey earlier in the year.

QUEBEC

★News from **East Malartic Mines** continues to be encouraging. Detail drilling of the big new orebody being developed at depth continues to outline substantial tonnage of ore with grade above mine average. The 15th level now shows 300 ft. averaging $12.09 across 52.5 ft., volume being smaller but grade higher than on the 16th (bottom) level, where the ore was first disclosed. In the meantime, shaft deepening to open three more levels is continuing.

★Drilling has been started on surface at the Noranda district property of **West Wasa Mines**, which in past years was the scene of considerable copper production by Aldermac Copper Corp., which later failed. The new project is being financed by interests connected with Ventures, Ltd., headed by Osisko Lake Mines, and the 17,000-ft. program will not be completed before early spring.

★Considerable excitement was aroused late in the summer by a copper dis-

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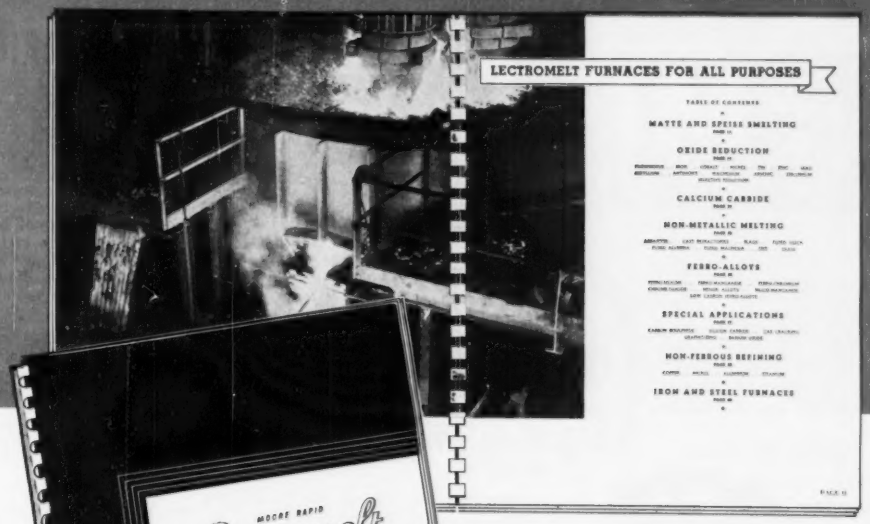

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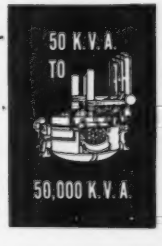


Quebec *(Continued)*

covery made at Windy Lake, **Opawica Lake area**, about 150 mi. northeast of Val d'Or. Few details had become available at press time, but upwards of 200 claims had been reported staked, with representatives of many prominent companies in the field securing ground. The original discovery was made on behalf of Lodex Mines.

SASKATCHEWAN

★**Beta Gamma Mines Ltd.** will concentrate on the Chum group near Beaverlodge Lake for the rest of the season. Surface prospecting and diamond drilling will be continued on the Chum group, a minimum 4,000 ft. to be driven to outline the Charlotte ore zone. The work is expected to provide sufficient data for a decision on shaft sinking and underground work. Beta Gamma properties include 110 claims in six groups about 3.5 mi. northwest of Uranium City. Considerable prospecting has been done on the BT and Chum groups, large low-grade deposits of radioactive minerals in pegmatite being indicated on the BT. Promising indication of high-grade ore has been found in the Chum group, where two zones, one 800 ft. long and the other more than 1,000 ft. long have been traced on the surface and by geiger counter and surface stripping.

YUKON

★**Mackeno Mines Ltd. and Yukeno Mines Ltd.** have purchased a 150-ton mill and flotation plant. It will cost an estimated $500,000.

★Construction of a $200,000 road is being considered by United Keno Hill to connect Keno City with the top of Keno Hill, where an unexplored deposit with gold-ore content may be developed. The company is said to be producing 100 tons of silver-lead ore daily with the expectation of doubling that amount by 1954.

IN LATIN AMERICA

MEXICO

★Only Mexican companies and individuals will be authorized **to exploit oxidized minerals of iron**, other than ochres, President Miguel Aleman decreed. Franchises based on technical and economic competence will be issued effective for 30 years and will be renewable for 20 years contingent on fulfillment of obligations. Foundry facilities proportionate to mine output will be required.

★**Republic Steel** is to spend 80-million pesos ($9.25-million) working rich iron deposits at Tapatitla, near Jalapa, the Vera Cruz capital, Governor Marco Antonio Muñoz announced. The state has granted Republic special facilities.

PERU

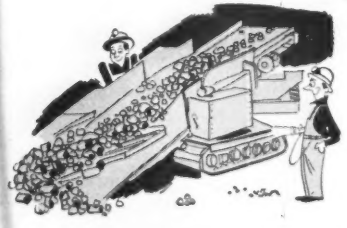
★**Lima** has been chosen as site of the second regional office of DMPA, which speaks highly of the importance the American Government is placing in Peruvian production of materials, particularly mining. This news has been favorably received by Peruvian miners and is expected to have an important effect on development of the industry.

★**Cerro de Pasco Corp.** recently inaugurated its new electrolytic plant for producing 35 tons of refined zinc at La Oroya. The official ceremony was attended by leading mining and political authorities of Central Peru. A. H. Engelhardt, manager of operations, spoke, and the plant was formally opened by the minister of Fomento, Eduardo Miranda Sousa.

★Victor Kravchenko, author of the best seller *I Choose Freedom*, has formed **Chavin Mines Corp.** to operate between the Cercapuquio mines and Chincha. Mines are said to have ore averaging 15% lead, 17% zinc, 2.5% copper, and 5.5 oz. of silver. High-pressure route of 80 km. in rough country has just been completed, after less

Canadian MINING ON THE MARCH

In early Canadian mines, the mucker used shovel, pick and hammer—and his own brawn. Today the shovel has largely disappeared from underground, except in the work of sinking shafts, where confined space normally prevents use of loading machinery.



Successors to the shovel are mucking machines, such as the compressed air-operated truck-type loader which requires no rails. In another modern method, tracks are laid as tunnelling proceeds, and mucking machines, operating on rails, scoop up each "round".

The mechanization of mucking is only one example of the great seven-league strides Canadian mining has taken within the past 50 years. Atlas Steels Limited, producers of tool and specialty steels for mining and other industries, have kept pace with this progress in the development of new steels designed for mining's toughest jobs.

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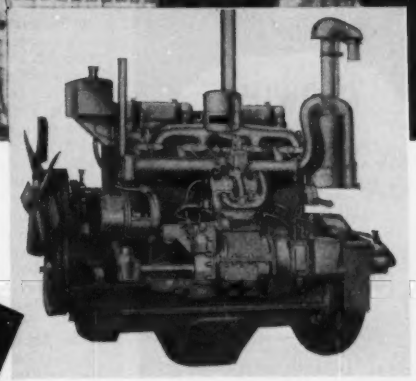

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Peru *(Continued)*

than three months, by a Peruvian contracting firm.

★San Antonio de Esquilache mines have been purchased by **Compania de Minas del Peru**, subsidiary of the Hochschild group, and are being worked vigorously. Production has been increased from 150 to 250 tons, and 400 tons of ore is being worked per day, producing lead and zinc concentrates from a low-grade ore. Deposits are said to be very large, and it would not be surprising if further expansion should be undertaken in the near future.

IN THE PACIFIC

PHILIPPINES

★**Philippine gold mines** have obtained a six-month extension in the application of the full statutory minimum wage law, along with manganese producers. Iron, chromite, and copper mines get a three-month extension. The open-market price for gold after sinking to P98 per oz. recovered to P103 in September.

According to a petition filed with Labor Secretary Jose Figueras, seeking deferment of the $2-a-day minimum, it costs about $48 on an average to produce an ounce of gold at today's labor cost ($1.50 minimum, plus subsidized housing and free medical care, often free schooling), while the mines take in only about $46.25. This figure is the weighted average from sales to the government at $35 per oz. (one-fourth of total output) and sale of the rest in the free market.

An increase in the minimum wage to $2 would up costs per ounce by $4 to $5, according to the petition. On the other hand, taxes amount to about $8 per oz. produced. The extension is sought with a view to prevailing on the next Congress to legislate tax concessions big enough to offset the wage increase.

★Output of chrome ore from **Consolidated Mines**, which is operated by Benguet Consolidated on a profit-sharing basis, continues to climb. August, the most recent month for which figures are available, was the best month of the year to date, with production of 51,800 tons valued at $751,000. This compares with production of 28,800 tons in January and an average of 25,100 tons per month in 1951. Washington agencies have recently authorized the purchase of an additional 250,000 tons of Masinloc chromite to be delivered to the government stockpile over a period of two years from July, 1953, with a price to be fixed every six months. Benguet Consolidated will proceed with construction of a railroad from the mine to the pier, a distance of about 30 km., to eliminate the heavy cost of truck haulage. Orders have also been given for a duplicate Heavy-Media plant with necessary additions to the washing plant. Total expenditures will exceed $1-million. The value of Consolidated's monthly output now exceeds that of any other individual mining operation in the Philippines other than that of Lepanto.

IN AUSTRALIA

★While geologists and drilling crews from Broken Hill probed uranium deposits in Rum Jungle for Australian Zinc Corp., new orebodies of potentially commercial value were turned up 110 mi. away in the Edith River area and at Nichol's Know, an old copper-mining area in South Australia. First reports said the Edith River deposit apparently extends a considerable length.

Terms of a general agreement between the Australian Government and **Zinc Corp., Ltd.**, of London, call for rapid development of Rum Jungle on behalf of the Commonwealth, government financing, and payment of a management fee. "The government," said Supply Minister Howard Beale, "is also considering an organization to control the whole project and the general development of Australian uranium resources."

Selection of a site for the refinery was still on the company's agenda. On-the-spot treatment seemed an unlikely solution due to the shortage of fuel, but the transportation problem will be easy. The mine is on the rail line to Darwin, and there's a good road only 2 to 3 mi. away.

The British-American Joint Agency for Development of Uranium will supply technical assistance as needed.

NORTHERN TERRITORY

★**Zinc Corp., Ltd.**, has taken a three-year option on a major lead-silver deposit in Arnhem land at the Bulman Hole on Wilton River, 30 mi. north of Mainoru. The deposit occurs in a horizontal lode formation, and it is believed possible to work it by open-cut with giant bulldozers. The corporation is believed to be interested also in a silver-lead deposit at McArthur River, about 40 mi. south of Borroloola.

IN AFRICA

★**Uranium contracts** have involved so much money that uranium output will soon bring in as much revenue for the Union of South Africa as gold, Minister of Mines J. H. Viljoen told the Nationalist Party Congress. The statement implies the gold mines' £150-million annual sales output will be doubled as a result.

The country will stockpile enough uranium, however, to supply its atomic research program and to ensure ade-

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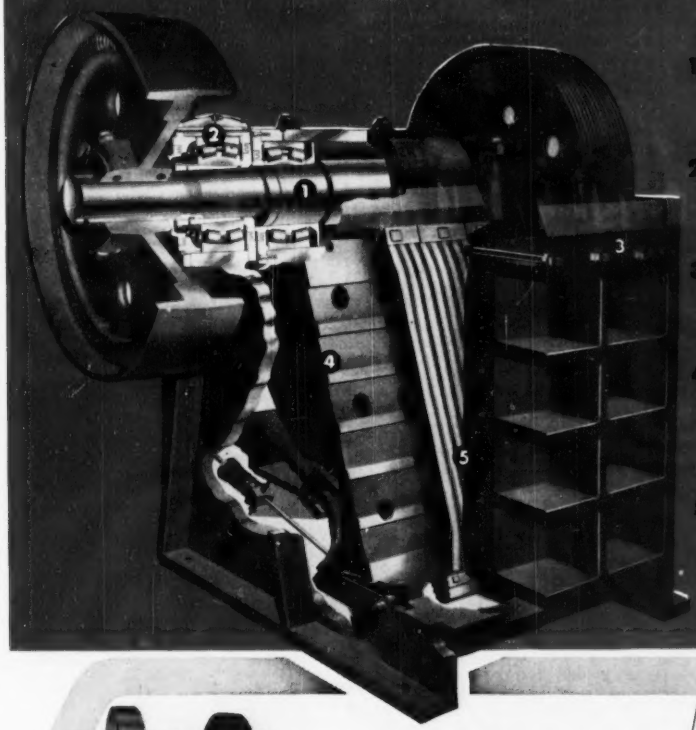

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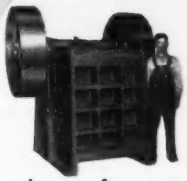

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★**The Bird reef series in the Central Rand,** idle because the gold price has been too low to make its working economical, will be worked vigorously for uranium recovery from slimes residues. Two of the eight additional gold mines enlisted in the uranium program will work the Bird reef. They are Luipaards Vlei and Randfontein Estates.

Western Holdings, Welkom, Free State Geduld, President Brand, President Steyn, and Virginia G. M., all gold enterprises in the Free State field, were also listed to participate.

★Engaged in a losing battle against rising working costs, more and more of **Southern Rhodesia's small gold miners** are branching out into base minerals to keep in operation. Some of them hope for a gold boom within the next few years but are mining scheelite deposits to carry them through.

During the past eight years, 316 small gold producers have been forced out of existence through higher costs rendering gold deposits uneconomical, and more are expected to close down this year. Many of the existing 476 producers have found negligible relief from premium gold sales which started towards the end of last year. They have received around $1.65 an ounce extra, but this has not compensated for the increased costs.

★The government will spend £45-million for three power stations to supply gold mines in which uranium is being extracted from tailings.

★Work was begun recently on the Union's first cyclotron. It will be used to manufacture radioisotopes.

★**Tsumeb Corporation,** a large producer of lead-zinc concentrate in Southwest Africa, is erecting a mechanical loading plant at Walvis Bay. It is already on site and should be operating early next year. A new vertical shaft recently reached a depth of 2,965 ft. Sinking operations had been retarded by inflows of water from fissures in the dolomite, but this has been countered.

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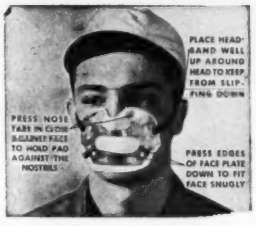
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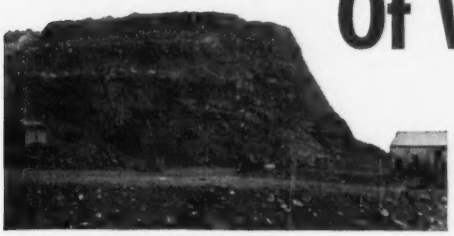

Before the blast, the 300 x 250 ft. island stood 150 ft. high, with a top capping of approximately 40 ft. of hard, blocky taconite. The rock became progressively softer, bottoming in ore at a depth of 100 ft. For the shot, 108 holes were drilled from 60 to 100 ft. deep, on 25 x 25 ft. spacings.

Excellent breakage obtained with Du Pont "Nitramon" is shown here, following the huge blast at Sellers-Day Island. The well-broken rock, requiring a minimum of blockholing, is ready for easy and economical removal.

USING 238,000 lbs. of "Nitramon,"* the Oliver Iron Mining Division of the United States Steel Company, Hibbing, Minnesota, recently blasted the overburden of Sellers-Day Island. Over 287,000 cubic yards of well-broken rock were produced by the blast, believed to be the largest ever made in this area.

SAFETY: Du Pont "Nitramon" is the safest blasting agent known. It cannot be detonated with commercial blasting caps and is insensitive to open flame, friction and even the impact of rifle bullets. It can be readily detonated, however, with a "Nitramon" primer—itself relatively insensitive.

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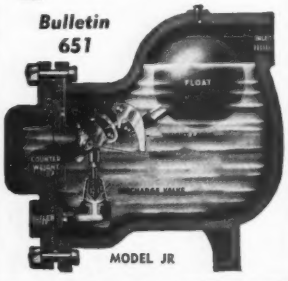

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Induced Radioactivity

(Continued from page 99)

possible. There is a considerable amount of overlapping between activities of various minerals, but many combinations of minerals show activities which differ by more than an order of magnitude. For instance, feldspars (10^6 cpm/g.) could be distinguished from most iron minerals (10^3-10^5 cpm/g.); copper minerals (10^5 cpm/g.) could be distinguished from pyrite (10^3 cpm/g.), and so forth.

Effect of Radioactive Decay on Separation—Table III is a tabulation of the estimated and experimentally determined half-lives of those minerals for which the experimental data appeared most reliable. The experimental half-lives were measured as described in the section on determination of counting rate. The first two columns in Table III list the mineral species and the estimated decay characteristics based on the most susceptible element in the mineral. The third column gives the experimentally determined half-lives observed in the minerals and lists the element whose half-life corresponds most closely to the experimental result. It is seen that in three cases two half-lives and two corresponding elements have been listed. In these instances there was a rapid initial decay followed by a slower decay. The rate of decay in the remainder of the cases was essentially constant during the five-minute period of counting.

From Table III it is seen that in many cases impurities contributed the largest part to the minerals' activity, resulting in wide deviations between the estimated half-life and the experimentally determined half-life. Galena and hematite are two examples. On the other hand, the copper, aluminum and silver minerals listed in Table III show good agreement between the estimated and measured half-lives. These results bear out the conclusions drawn from the data summarized in the cut on p. 97; that is, the minerals whose estimated activities are low are those most markedly affected by impurities.

A further observation to be made from Table III (and borne out qualitatively by the information on half-life for the mineral specimens not listed in Table III) is that the majority of the minerals have half-lives of the order of minutes. This half-life corresponds roughly to that of aluminum which, indeed, appears to be the most common impurity. The rather close correspondence of half-lives among many mineral specimens would appear to limit the usefulness of a mineral separation process based on differences in half-life.

Mineral Suites from Four Mines—The graphs at the head of this article show curves of log activity versus time for mineral suites from different mines. They indicate that for most of these minerals, a separation could be made on the basis of initial activity.

In general, the half-lives of minerals from a given mine appear to be similar. However, if the minerals were deposited in the orebody at different times and under different geological conditions, it would seem quite likely that the different minerals would contain different impurities. The data from St. Joe in Missouri indicate that this may be so. Here the limestone host rock has a different half-life from the galena, which was probably deposited from a different source and at a later time.

Activation of Some Industrial Diamonds—Table IV is a tabulation of the beta and gamma activities for five specimens of industrial diamonds. Pure carbon should show no measurable activity under the irradiation conditions of this experiment. Distinguishing the diamonds according to color, it is seen that the white, clear diamond gave the lowest beta activity, as was expected. The colored diamonds gave activities up to 100 times greater than the white diamond. The range of beta activities of 10^4-10^6 cpm per gram is much higher than was expected and in the case of the colored diamonds, is undoubtedly due to impurities. The gamma activities, measured with an absorber of 220 mg/cm^2, for these same specimens gave results more as expected. The white, yellow, and grey diamonds had no measurable activity. Only the black diamond and blue diamond showed high activities.

Conclusions

The results of these tests show that, in general, the initial activity of a mineral species is higher than the estimated activity based on a pure chemical compound. It

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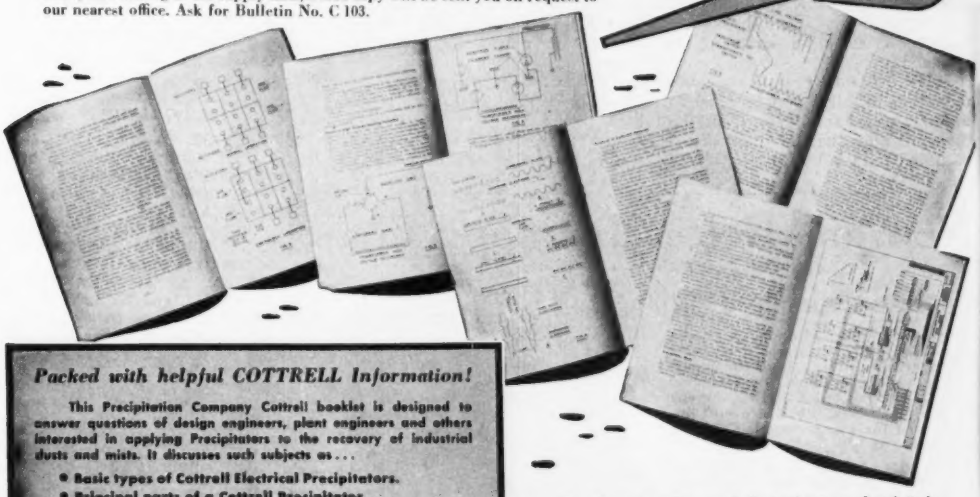

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is shown further that these deviations are greater for minerals which have a low estimated activity. There is also a considerable spread of measured activities among specimens of the same mineral species. These facts tend to reduce the resolution between mineral species and limit to a certain extent the effectiveness of a separation based on the values of initial activities. However, there remain sufficient differences in many cases so that separation would be possible.

Trace impurities in minerals with low estimated activities also tend to make the half-lives of the mineral activities lie within narrow limits. In fact, when minerals suites from four different mines were investigated, it was found that the decay characteristics of all of the minerals from one place were almost identical. Thus, the effectiveness of a separation based on selective counting is reduced.

It is evident from the results described in this report that, while a few general conclusions may be drawn about the behavior of irradiated minerals, each orebody would represent a specific problem. This process of mineral separation is shown to be practical within limits, the most effective principle being a separation based on relative values of the initial activities. In general the half-lives are short so that radioactive health hazards are minimized. The activities measured in most cases were more than ample to actuate a conventional gate circuit quite readily. In fact, it was apparent from these tests that the neutron flux such as exists in a reactor is unnecessarily high by a factor of 10^2-10^3.

Many of the practical engineering details remain to be worked out. Some of these are the effects of particle size and time of irradiation, the design of an electronic circuit to give maximum sensitivity and a method of feeding the ore.

The biggest problem at present is a suitable source of neutrons. Except for a nuclear reactor or the D-D reaction using a cyclotron, the existing neutron sources have a neutron flux which is too low (maximum about 10^7 n/cm²/sec.). The flux in a pile is actually too high (about 10^{12}-10^{13} n/cm²/sec.). It therefore appears that a cheap, simple source of neutrons with a flux of about 10^9 n/cm²/sec. would be required for the successful application of this idea.

Acknowledgments

The authors would like to express their gratitude to Dr. Marvin Fox, Mr. J. Floyd and the members of the staff at the Brookhaven National Laboratory reactor for their invaluable assistance in making our stay at Brookhaven both successful and pleasant. They also thank Professor H. R. Spedden and the other members of the staff of the Richards Mineral Engineering Laboratory for encouragement and constructive criticism, and Mrs. V. Ross for assistance in preparing the mineral specimens and assisting with the calculations.

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TO OBTAIN A COPY of the data in the appendices to this article, write either to Professor A. M. Gaudin, Richards Mineral Dressing Laboratory, Massachusetts Institute of Technology, Cambridge, Mass., or to The Editor, Engineering & Mining Journal, 330 West 42d St., New York 36, N. Y.

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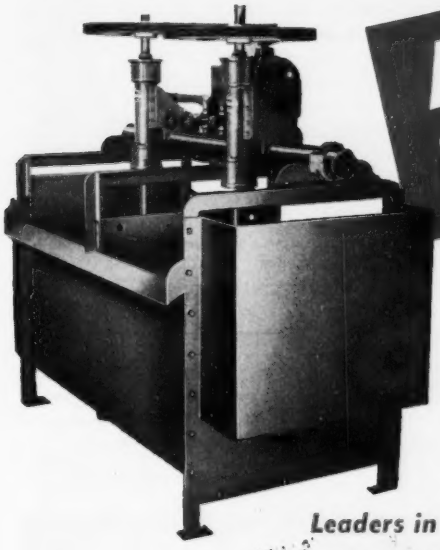

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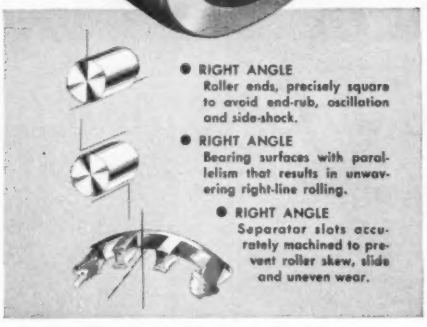
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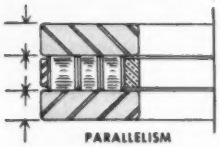

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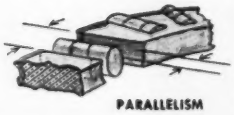

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● ACCO *Registered* DUALOC* Boom Cables are completely flexible with double-hinge action. They absorb vibration. No heat, acid, solder, tape, or tuck is used. No shear stresses are set up in rope so every DUALOC Boom Cable develops full catalog breaking strength of rope used. Open construction permits reliable inspection at all times.

Each completed DUALOC Boom Cable assembly is proof tested to two times its rated capacity before Registry Certificate is issued. DUALOC assemblies are the only replacements for wire rope sockets which do not lower safety factor originally built into your equipment. They are easy to install as their endings have same dimensions as zinced sockets. No alterations to equipment are necessary.

Write today for literature and quotation.

*Trade Mark Registered. Patent No. 2463199.

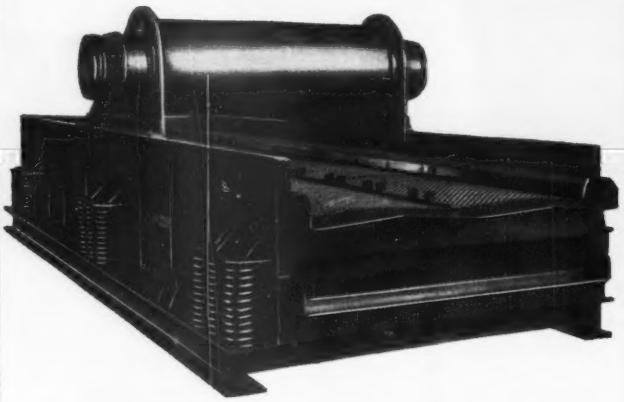
ACCO

TRADE MARK

WIRE ROPE SLING DEPARTMENT
AMERICAN CHAIN & CABLE

Wilkes-Barre, Pa., Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

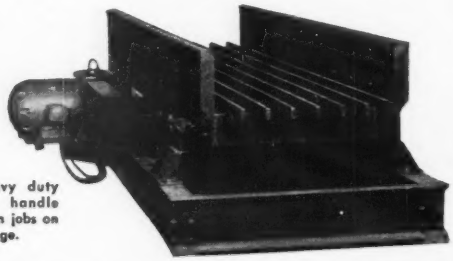
ACCO Registered DUALOC Slings



SIMPLICITY gyrating screens are doing a fast, efficient sizing and dewatering job for the metal mining industry

The 6' x 20' Simplicity Model OM Double Deck Screen shown here is typical of Simplicity Screens used successfully at the great Mesabi Range in Minnesota to size and dewater iron ore. This screen, with a ⅝" opening on the top deck and a 1½mm. dewatering surface on the lower deck, is designed for heavy media concentration of iron ore.

Throughout the metal mining industry, Simplicity equipment is handling all types of preparation work from coarse scalping to fine screening and dewatering. Simplicity operating mechanism insures fast, accurate sizing and keeps production costs down.



Simplicity heavy duty scalpers also handle tough production jobs on the Mesabi Range.

Simplicity
TRADE MARK REGISTERED

ENGINEERING CO. • DURAND, MICHIGAN

Sales representatives in all parts of the U.S.A.
FOR CANADA: Canadian Bridge Engineering Co., Ltd., Walkerville, Ontario
FOR EXPORT: Brown and Sites, 50 Church Street, New York 7, N. Y.

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TAILORED TO FIT YOUR NEEDS...

Smelter bags of tailor-made **FUMEALL** filter fabric are now operating in the bag houses of many of the world's most important smelters. The operating records of **FUMEALL** filter bags show substantial savings over conventional fabrics...often giving as much as four times the service of all-wool bags.

FUMEALL, a combination of virgin wool and Dynel, combines the undisputedly superior filtering qualities of wool with the strength, heat, acid, alkali and moisture-resistance of Dynel.

FUMEALL is tailor-made to the exact porosity and weave which meet your specific requirements . . . **FUMEALL** can be ordered as yardage or as completely fabricated bags of any size and specification.

INDUSTRIAL FABRICS DIVISION

Portland Woolen Mills, Inc.

P.O. Box 2620 • Portland 3, Oregon, U.S.A.

OFF THE ROAD

GENERALS

ON THE ROAD

Resist cuts, scrapes, bruises...
Give more traction! More speed!
More safety—
WORK FASTER... LAST LONGER... COST LESS
more profit for you per job!

GENERAL L. C. M. Broad, deep, self-cleaning tread lugs and reinforced shoulders for more traction off-the-road. Longer wear on razor sharp mine and quarry surfaces.

GENERAL H. C. T. for most work on-the-road, some off. More rubber, more cords per inch for greater safety. Extra traction through sand, gravel, slush, mud.

THE GENERAL L.C.M.

THE GENERAL H.C.T.

Make Every Worn Tire Work Longer for More Profit!

Your GENERAL TIRE DEALER will KRAFT SYSTEM RECAP Worn Tires with the New GENERAL Truck Tire Tread of Your Choice

KRAFT SYSTEM RECAPPING
A GENERAL TIRE SERVICE

You're throwing away money when you throw away worn tires or accept an ordinary "adjustment" for them. Let your General Tire Dealer—a tire expert—restore worn tires with famous factory controlled Kraft System Recapping. You choose from the complete line of on and off-the-road new General Tire treads and he'll put that tread on your worn tire. He can do sectional repairs too. Get Kraft System Recapping—get more profit from every tire.

SPECIFY GENERAL TIRES ON YOUR NEW EQUIPMENT

NOW! THE TOUGHEST

SHOT FIRING CABLE

EVER PRODUCED!

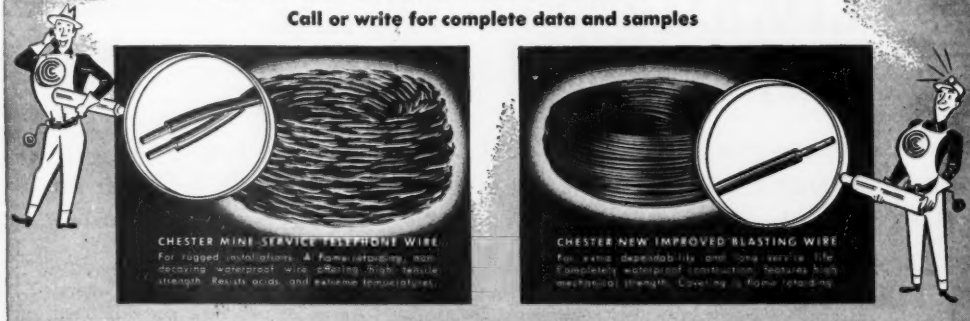
Check the long life qualities offered by this *SUPER DURABLE* SHOT FIRING CABLE

- RESISTS SHARP EDGES AND ABRASION
- FLAME RETARDING AND WATERPROOF
- NON-DECAYING AND NON-AGING
- HIGH STRENGTH AND FLEXIBILITY
- NON-CRACKING FROM −40°C to +80°C
- RESISTS MOST ALKALIS, ACIDS, OILS, GREASES
- IMMUNE TO OZONE AND SUNLIGHT

Exclusive CHESTER nylon jacket over center core increases service life and promotes mine safety

Here's the shot firing cable you can depend on for really tough mine service. It's highly durable when exposed to sunlight and ozone, withstands dragging over sharp edges and abrasives and is highly flexible. Non-cracking over a wide temperature range, Chester is flame retarding and waterproof—the kind of cable that's good for years of usefulness in all types of mining operations. Ask for Chester the next time you order — you'll agree, IT'S THE TOUGHEST SHOT FIRING CABLE EVER MADE!

Call or write for complete data and samples


CHESTER MINE SERVICE TELEPHONE WIRE
For rugged installations. A flame-retarding, non-decaying waterproof wire offering high tensile strength. Resists acids, and extreme temperatures.
CHESTER NEW IMPROVED BLASTING WIRE
For extra dependability and long service life. Completely waterproof construction. Features high mechanical strength. Covering is flame retarding.

CHESTER CABLE CORP.
CHESTER, NEW YORK

MANUFACTURERS OF QUALITY WIRES AND CABLES FOR EVERY INDUSTRIAL AND COMMERCIAL APPLICATION

IN MINES and QUARRIES

JOB AVAILABILITY PAYS OFF!

Euclid Bottom-Dump Coal Haulers of 20 to 40 ton capacities have diesel engines to 300 h.p. . . . loaded speeds up to 34.4 m.p.h.

Rear-Dump Euclids of 10 to 34 ton capacity have travel speeds to 36.3 m.p.h. with full payload and diesel engines of 125 to 400 h.p.

For open pit mining and quarry operations, Euclids are unmatched for job availability and long service life. "Eucs" have large capacity and plenty of power and speed to move more loads per hour at more profit per ton.

Bottom-Dump Euclids are engineered and built as complete units with good weight distribution, and tremendous power. Short wheelbase of the tractor and the universal hitch design make them easy to handle and permit short turns in narrow cuts.

Rear-Dump "Eucs" have body designs for all types of materials—coal, ore, rock, overburden and other heavy excavation. Their rugged construction withstands the impacts of loading heavy materials and travel on rough roads—assures low operating and maintenance costs.

Put Euclids on the job and be on more jobs! Ask your Euclid Distributor for information on the models best suited to your off-the-highway hauling requirements.

The EUCLID ROAD MACHINERY Co.
Cleveland 17, Ohio

EUCLIDS *Move the Earth*

NEW Cedarapids Built by IOWA Schrock Motorized HEAD PULLEYS

SIMPLIFY EVERY BELT CONVEYOR AND BELT-BUCKET ELEVATOR INSTALLATION

IT'S COMPLETELY DIFFERENT FROM CONVENTIONAL CONVEYOR DRIVES

Everything is contained **INSIDE** the pulley!

ELIMINATES ALL MAINTENANCE ON SPROCKETS, CHAINS, JACK-SHAFTS, V-BELTS, ETC.

U.S. Pat. No. 3548399 Others Pending

WHAT A *Motorized* HEAD PULLEY IS

THIS is a revolutionary departure from the conventional types of conveyor drives. A *motorized* head pulley is a fabricated steel pulley with *everything*... electric motor, reduction gears and all moving parts . . . contained inside the drum! It's simply a new application of the long-proven gear reduction drive, and because of its simplicity, it's the answer to the maintenance man's prayer. 70% to 90% of conveyor down time is saved by eliminating all countershafts, speed reducers, sprockets, chains, Universal shaft drive and other parts necessary with conventional pulley drives. Motorized Head Pulleys are simple to install and flexible in use, completely interchangeable and adaptable to all types of belt and belt-bucket conveyor installations. By means of a simple adapter, a single pulley can be utilized in any of several belt locations, operating various widths of belt, or changing from larger or smaller horsepower. Pulley sizes range from 5 to 30 HP and are available in various widths. A Motorized Head Pulley is safe, because there are no sprockets, chains, jack-shafts, V-belts, etc. to endanger personnel. It's compact... requires no more room than a conventional pulley. Complete protection from weather, grit and dirt also reduces maintenance. Cedarapids Schrock Motorized Head Pulleys have been job-tested for many years under severest working conditions.

HOW IT WORKS

The pulley shell rotates about the electric motor, which is held stationary by means of a torque arm attached to the conveyor frame. The speed of the shell depends upon the combined reduction ratio of the various pinions and gears contained within the pulley shell. This reduction starts with a primary pinion mounted on the motor shaft and ends in the ring gear attached to the shell. The shell in turn then drives the conveyor belt. Leads to the motor enter the head pulley through a hollow conduit passing through the drum end bell and bearing. A simple oil bath gear compartment provides a lubricating bath for the reduction gears and front motor bearing. Motor and head pulley are cooled and ventilated by holes in the drum.

GET COMPLETE DETAILS TODAY

Find out all the advantages of converting your conveyor installations to motorized efficiency before you need head pulley replacements. One internationally known company has 50 Motorized Head Pulleys installed on widespread conveyor operations, and plans more for every installation that requires replacement. Get complete details about every feature. See your distributor today, or write direct to Iowa Manufacturing Company.

IOWA MANUFACTURING CO.
Cedar Rapids, Iowa, U.S.A.

Built for sale in Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah and Washington.

YUBA MANUFACTURING CO.
Pulley & Sprocket Dept., Benicia, California

IT PAYS TO MAKE "ONE MANUFACTURER"

RESPONSIBLE FOR ALL YOUR GEARS & SPEED REDUCERS

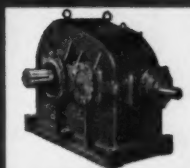
PHILLIE GEAR®

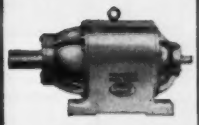
Herringbone Reducer

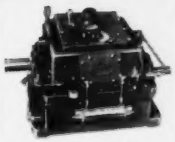
Vertical Worm Reducer

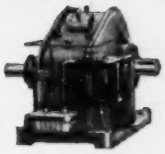
We design and manufacture *"every type and size"* of Gear and Speed Reducer . . . This fact is *important* because: (1) It assures the purchaser of our "unbiased" recommendations; (2) Permits ordering from "one source" of supply; (3) Enables the purchaser to place the *responsibility* for the operation of their Gears and Speed Reducers upon the shoulders of "one manufacturer."

Your inquiries are invited for information on any type of Gear or Gear Driven Product which includes the widely used *"Limitorque" Motor-Operated Valve Control.*
Send for catalog on any product.


Spiral-Bevel Reducer

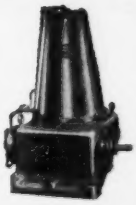

Planetary Reducer


Change Speed Unit


Speed Increaser

Gearmotor

Heavy Duty Worm


Steeple Type Worm

Continuous Tooth Herringbones up to 60" diameter. Separated Tooth Gears up to 150" diameter.

Worm Gears up to 150" diameter. Worms to match.

Spur Gears up to 150" diameter. Larger gears in bolted sections.

Vertical Motor Reducer

—Over 60 Years in the Gear Business—

Philadelphia Gear Works, INC.

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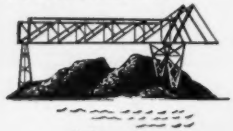
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

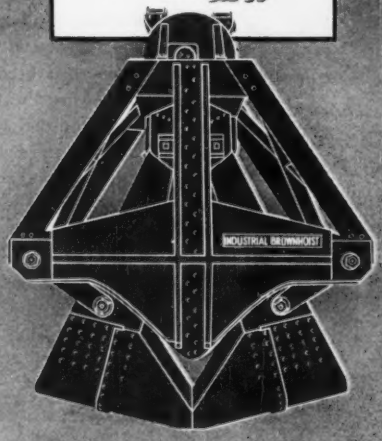
Industrial Gears and Speed Reducers
LimiTorque Valve Controls

BROWNHOIST

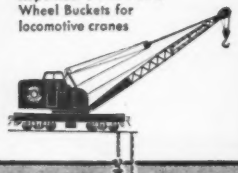
ALSO BUILDS BETTER BUCKETS

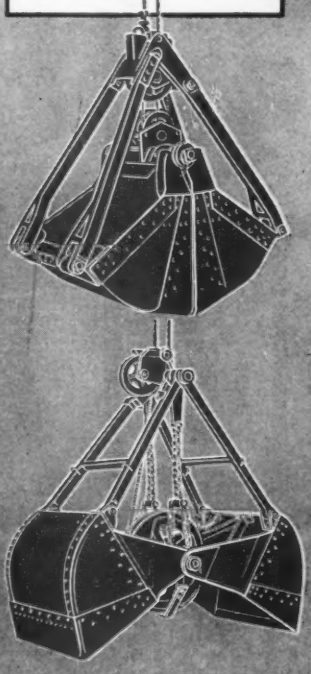
Link Type Buckets for boat unloaders, bridge cranes, fast plants





Rope Reeve and Power Wheel Buckets for locomotive cranes





Brownhoist Buckets are designed for specific jobs and especially engineered to meet the toughest materials handling requirements. They take deep, full capacity bites that move more materials per lift, thus making possible considerable savings in man-hours and production time. They are built for endurance and dependability, the same qualities that have accounted for Brownhoist leadership in the bulk materials handling field for more than three quarters of a century. Railroads, steel mills and dock operators who are loading and unloading coal, ore, slag or other bulk materials will find it pays to discuss their requirements with Brownhoist engineers.

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BROWNHOIST builds better cranes

INDUSTRIAL BROWNHOIST CORPORATION • BAY CITY, MICHIGAN • DISTRICT OFFICES: New York, Philadelphia, Cleveland, San Francisco, Chicago; Canadian Brownhoist, Ltd., Montreal, Quebec • AGENCIES: Detroit, Birmingham, Houston, Los Angeles

PRODUCT AND PROCESS ADVANTAGES

increase demands for Ductile Iron

DUCTILE IRON PROVIDES mechanical properties which approach those of cast steel. In addition, it combines the *machinability and wear-resistance* as well as the *fluidity and castability* of cast iron.

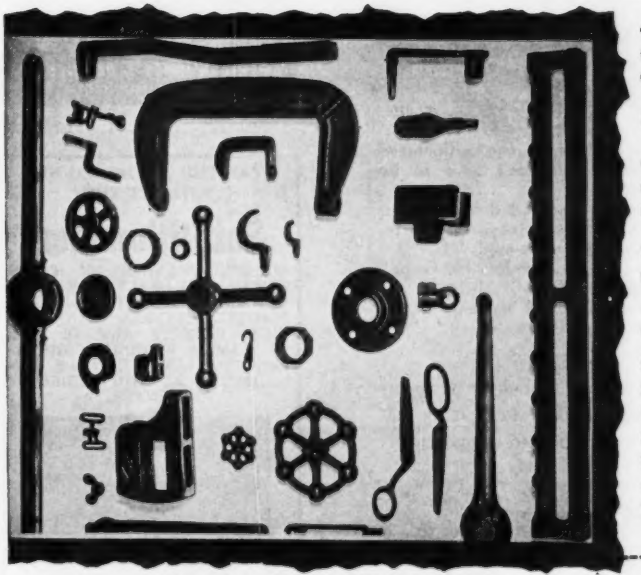
Presence of spheroidal rather than flake graphite not only gives this new material ductility that is unique among cast irons, but contributes much to its other exceptional properties.

REMARKABLE CHARACTERISTICS OF DUCTILE IRON

1. Its elastic modulus, about 25,000,000 psi, is virtually unaffected by composition or thickness...

2. It can provide a chilled, carbidic, abrasion-resistant surface supported by a tough ductile core.

3. As-cast ductile iron of 93,000 psi tensile strength has the same machinability rating as gray iron with a strength of 45,000 psi.



COURTESY OF ACME SHEAR COMPANY, BRIDGEPORT 1, CONN.

4. Annealed ductile iron can be machined at a rate 2 to 3 times that of good quality gray iron.

5. It can be satisfactorily welded.

6. It resists oxidation and growth to an extent never before available in gray iron castings.

7. It can be cast in intricate shapes not normally feasible for cast steel.

AVAILABILITY

Send us details of your prospective uses, so that we may offer a list of sources from some 100 authorized foundries now producing ductile cast iron under patent licenses. Request a list of available publications on ductile iron... mail the coupon now.

Ductile Iron offers excellent castability, high mechanical properties and good machinability. Castings show superior pressure tightness, good elastic modulus and resistance to shock. They range from those weighing a few ounces... with sections as thin as one-tenth of an inch... to 50-ton anvil blocks with sections 4' thick.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 WALL STREET, NEW YORK 5, NEW YORK

The International Nickel Company, Inc.
Dept. EMJ, 67 Wall Street
New York 5, N. Y.

Please send me a list of publications on:
DUCTILE IRON

Name_____ Title_____

Company_____

Address_____

City_____ State_____

NO!

Here, conventional U-Bolt clips are properly applied but rope is distorted and subject to life-shortening strains under load.

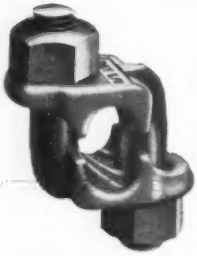
NO!

Inexperienced workmen can easily put conventional U-Bolt clips on incorrectly with saddles not on load-line. Result: Weakened rope — risk of accidents.

It CAN'T Go On Wrong

Both halves of the Laughlin Safety "Fist Grip"* clip are identical. There is no wrong way. The most careless workman can't put 'em on wrong (unless he forgets to tighten the nuts). And they're not only safer and practically foolproof, but they're a darn sight easier to use.

Here's why:



Nuts are out in the open, can be tightened with any wrench, and don't have to be "inched around."

Bolt ends are shorter and don't get battered or bent. Nuts are always easy to remove when clip is to be re-used.

No crushed rope ends, under "Fist-Grips" to cut off. Rope saved.

Fewer clips are required in many installations, so there is less work to do.

"Fist-Grip" Clips are just one example of many LAUGHLIN EXCLUSIVES in design, safety and quality that make Laughlin your best buy in wire rope and chain fittings.

Look for the trademark *to be sure*

THE THOMAS LAUGHLIN COMPANY
116 FORE ST., PORTLAND, MAINE

LAUGHLIN

THE MOST COMPLETE LINE OF WIRE ROPE AND CHAIN FITTINGS

*Patented, T.M. Reg.

Riggers PLAY IT SAFE on "high wire" jobs!

... that's why they demand GENUINE

CROSBY CLIPS

Drop-forged, hot-dip galvanized wire rope fasteners

SIZES FOR ⅛" TO 3" WIRE ROPE

DISTRIBUTORS EVERYWHERE

AMERICAN HOIST & DERRICK CO.
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Scintillometer

LOCATE URANIUM 100 TIMES EASIER. THE ONLY PORTABLE GAMMA RAY DETECTOR EMPLOYING CRYSTAL SCINTILLATION. DETECTS ALMOST 100% OF GAMMA RAYS IN COMPARISON TO LESS THAN 1% DETECTED BY THE GEIGER COUNTER.

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ALL TYPES GEIGER COUNTERS;
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ULTRA VIOLET LIGHTS

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"That's my buddy...that Thor is!"

Thor TOOLS

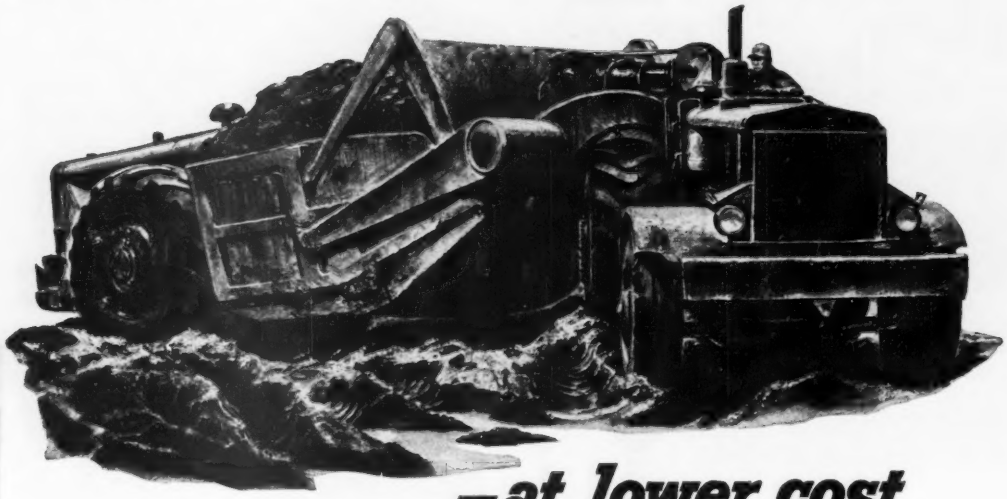
INDEPENDENT PNEUMATIC TOOL COMPANY
AURORA, ILLINOIS

Top side or under ground, Thor Sinkers or "pluggers" are money-makers . . . You'll find them No. 1 choice for sinking shafts . . . used with Thor Sinker legs, they bring tremendous savings in drifting or tunneling costs . . . for stoping, clamp a Thor Sinker to a Thor Raiser Leg. There are many good reasons why Thor Sinkers are 1st choice with mining engineers, mine operators and the miners themselves. For details, write Independent Pneumatic Tool Co., Aurora, Illinois, or Los Angeles, Calif.

PAVING BREAKERS • CLAY DIGGERS • TRENCH DIGGERS
CONCRETE VIBRATORS • ROCK DRILLS • BACKFILL TAMPERS
SUMP PUMPS • NAIL DRIVERS • SHEETING DRIVERS
CEMENT HAMMERS • ELECTRIC HAMMERS AND SAWS

FACTORY SERVICE BRANCHES IN 20 PRINCIPAL CITIES

Moves big payloads faster



—at lower cost

BIG earth-moving vehicles like this twin-engine self-loading scraper get more work done faster because of Allison TORQMATIC DRIVES. These time-proved hydraulic drives — more than 10,000 have been built for Army tanks and heavy-duty vehicles—make multiple engine applications possible —and practical.

TORQMATIC DRIVE provides a smooth, steady, oil-cushioned flow of power—high-starting torque with uninterrupted acceleration —protection against shock-load damage to engines and equipment. It eliminates engine lugging and stalling while maintaining power to drive wheels at all times. This permits the engine to operate in its most effective speed range by balancing engine power with load requirements.

Users of trucks, scrapers and other vehicles equipped with TORQMATIC DRIVE *report up to 30% more work done and 15% less cost per yard than with a mechanical drive* — additional good reasons why engineers are designing Allison TORQMATIC DRIVES into all types of heavy-duty equipment.

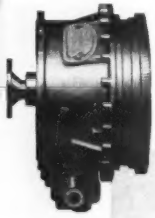
Allison TORQMATIC DRIVES are the only heavy-duty full torque-shifting vehicle transmissions available today—engineered for compactness, permitting flexibility of drive-train design for today's and tomorrow's vehicles.

Like to know more about TORQMATIC DRIVES? Write us for Engineering Data Bulletin which gives full specifications.

ALLISON *Division of* GENERAL MOTORS
Box 894M, Indianapolis 6, Indiana

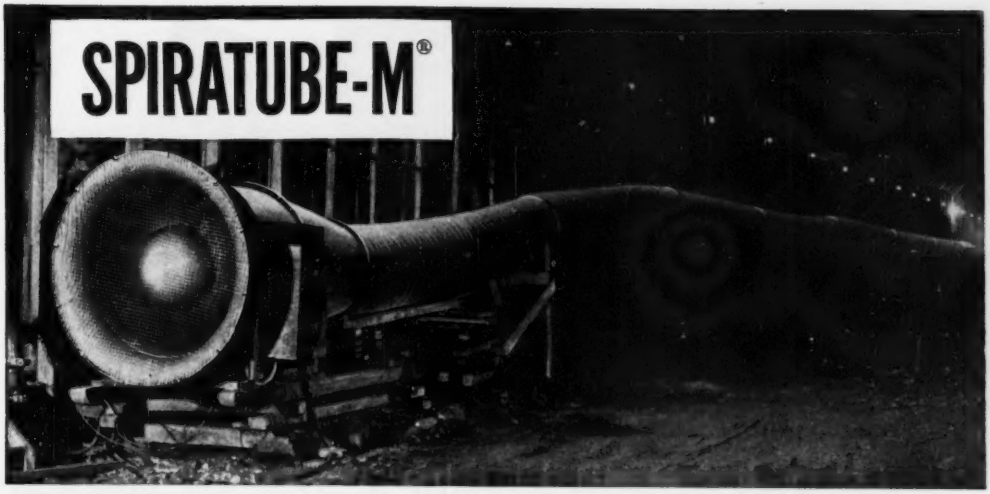
GM GENERAL MOTORS

Allison TORQMATIC DRIVES



Compact, efficient hydraulic drive for . . .

CRANES TRACTORS TRUCKS SHOVELS LOCOMOTIVES DRILLING RIGS



Simplify mine and tunnel ventilation

Here's the airduct that can take it! Now you can deliver air to the working face of mine or tunnel — cheaper! That's because SPIRATUBE-M is built to cut maintenance costs! Ease of handling reduces installation costs. Unique SPIRATUBE-M construction features minimize leaks and seepage. And you get the maximum efficiency of your blower or fan . . . cutting power costs!

Immediately available in diameters to 30 inches, from fully-stocked distributors, SPIRATUBE-M is made in tough high count fabrics, all specially treated and heavily coated inside and out to withstand fungus, mildew and rough treatment.

And, patented, *built-in,* quick-couplers eliminate the need for separate parts . . . no need to look for couplers when you're in a hurry.

For heavy duty, pressure ventilation tubing without wire reinforcement, ask for AYRTUBE®. Sold in diameters to 36", AYRTUBE by itself or in combination with SPIRATUBE-M offers you an inexpensive airducting.

Check these features:

Handling ease

Lightweight

Flexible

Easily installed by you

Takes sharp turns without crimping

Withstands fungus, mildew, rough treatment

Flexible Tubing CORPORATION

Guilford, Connecticut • Pasadena 1, California

FREE BOOKLET DESCRIBES SPIRATUBE-M and AYRTUBE MINING AND CONSTRUCTION APPLICATIONS. Write for your copy today.

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Company_____

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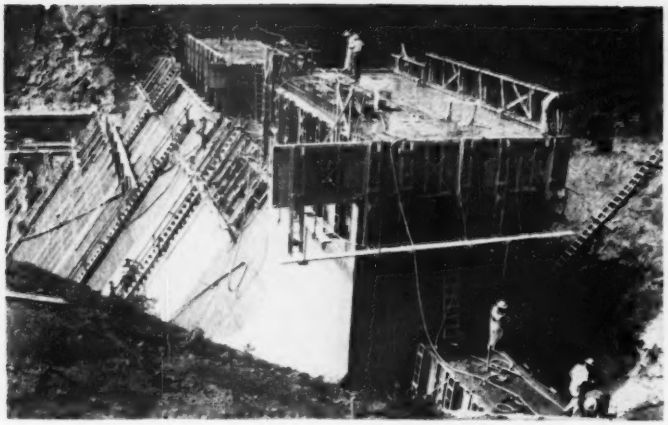

Philpott Dam finds solution to difficult Water and Air Hose problems

CHAMPION AIR DRILL HOSE

A super service hose of braided construction on oil-resistant tube, a strong flexible carcass and shock-resisting cover.

CHAMPION WATER HOSE

Top quality hose of wrapped construction, built with specially reinforced carcass, a smooth, friction-reducing tube and a rugged outer cover that provides maximum protection against external damages.

● Air and water hose, used in the Philpott Dam construction, came up against every enemy in the book. Changeable Virginia weather weakened hose resistance to high pressure loads, abrasive concrete structures clawed away hose covers, and the rocky terrain made deep, stabbing, carcass-penetrating wounds that caused sudden breakdown and work stoppage.

Ordinary hose wouldn't meet these challenges. Engineers, faced with rigid work schedules, couldn't put up with interruptions. They called in the local Republic Rubber Distributor, who, after a thorough study of all hose hazards, recommended use of Republic's Champion Air Hose and Republic's Champion Water Hose.

9,000 feet of these standard-built (not custom-made) pressure carriers went into immediate action for Philpott engineers who say Republic hose eliminated work stoppages and cut maintenance costs to absolute minimum.

Republic Rubber Products produce results like this for men in every industry. There's a complete line of Hose, Belting, Packing and Molded & Extruded Products. Just drop us a card regarding any one of these products.

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REPUBLIC RUBBER DIVISION

Lee Rubber & Tire Corporation

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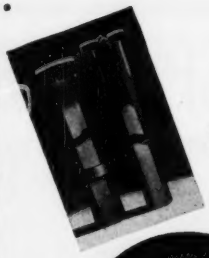
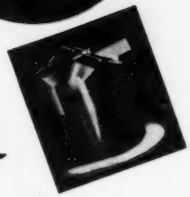


Intra-Set: chisel or 4-point —gage sizes, 1 ⅛" to 2 ½".

Choose EITHER ONE...



Rok-Bit: chisel or 4-point —gage sizes, 1 ⅝" to 4".

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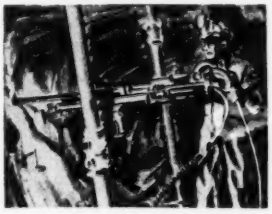
give you faster, lower cost drilling!



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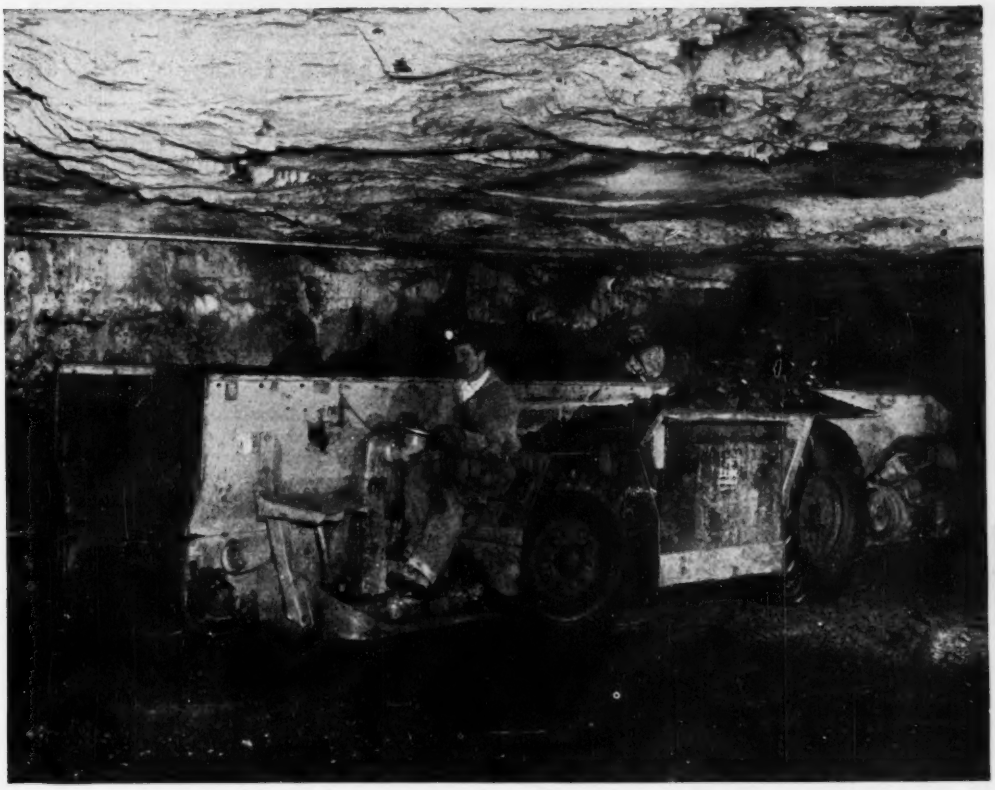

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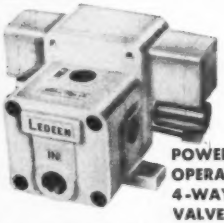

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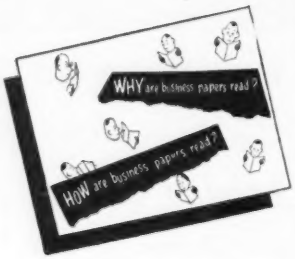

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Easily and quickly applied on the job or in the shop. Special design gives deep compression into belting and smooth, flush joint.

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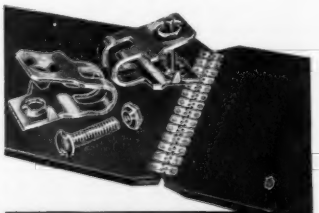

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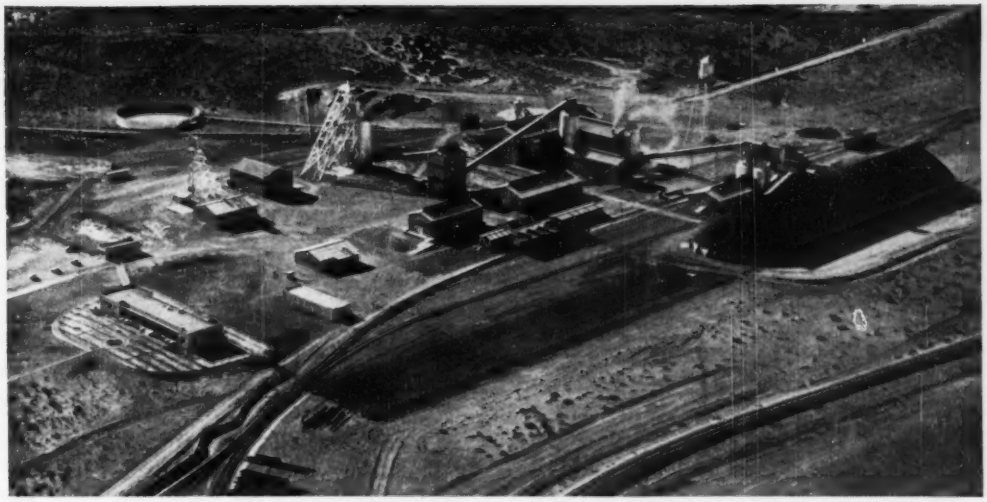

Overall air view of potash refinery.

America's most modern POTASH REFINERY

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This new potash plant has a rated capacity of 2400 tons of feed per 24 hours. It employs efficient methods and equipment which promise noteworthy increase in output per man hour. Full operation began in March of this year, and the first two months of operation completely bore out the capacity rating estimated by the Stearns-Roger engineers who designed the refinery, in accordance with a metallurgical flow sheet supplied by the customer.

There are two main shafts, both served by a common hoist house which also serves as main electric distribution center. Voltage of 4160 is broken down to 440 at a number of substations about the plant. A temporary head frame was used to sink the main ore shaft. If this had been dismantled prior to erection of the permanent head frame, a serious loss of time would have resulted. Stearns-Roger's solution was to build the 130-foot main head frame 80 feet from its permanent site and move it bodily into place when finished. This saved over a month's time in getting the plant into operation.

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THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine — the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it"—"they" being all the industry's front line of innovators and improvers — and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you—giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.

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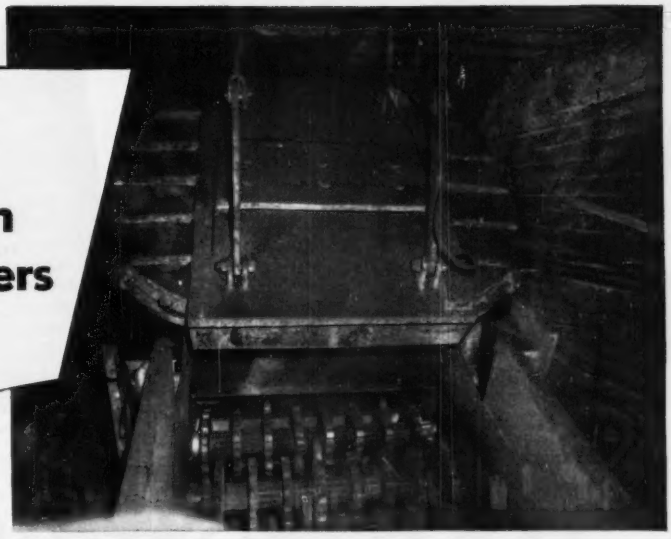
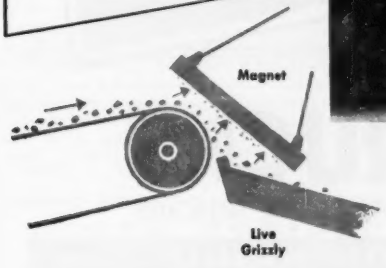
Stops Tramp Iron Where Others Fail!





New Dings Type RM Suspended Magnets Available with Effective Ranges up to 30"!

HERE IS a line of magnets to pull tramp iron from even the fastest, most heavily loaded belts.

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AND—they are lighter weight, cooler operating and use less current for their strength than previous models.

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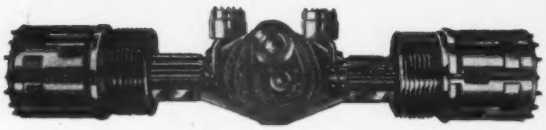

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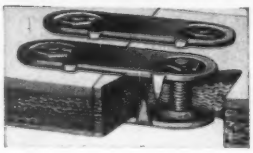

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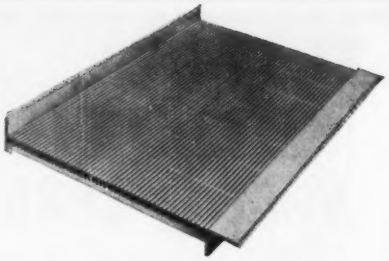

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1—404 HP Springfield Water Tube BOILER, 225# w.p. ASME Code, Boiler #3112.

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66 Gear Reduction Units.

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2451 Feet, steel encased, 4", 6", 7", 8", 9" and 12" dia. Most lengths motor driven.
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Only non-corrosive materials handled.

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Profitable Mine Operation—

calls for operating efficiency all along the line. These specialists in various phases of mine operation can aid you materially in determining quick, economical solutions to your mining problems that make for more efficient operations, resulting in lower costs and a consequent greater return on your investment. Consult them!

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NEW ADVERTISEMENT Address N. Y. Office, 330 W. 42nd St., N. Y. 36, N. Y. For December Issue closing November 20th.

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We are interested in a man under 45 years of age who has held a responsible operating position, at least Asst. Superintendent, and has had a minimum of 15 years of experience in non-ferrous concentration plants, mills and smelters. Must be a graduate engineer.

This man should have a wide acquaintance in the non-ferrous field, capable of contacting customers for engineering and construction contracts involving crushing, grinding and concentrating plants in the ferrous and non-ferrous field. Should also be capable of consulting and working with our engineering department when designing.

Also must be capable of starting up plants which we build.

Salary and participation in profit-sharing bonus.

Write and furnish full details of experience, background, education and salary required.

SW-5585
Engineering & Mining Journal
330 W. 42 St., New York 36, N. Y.

MINING ENGINEER
$18,000

Highly rated organization seeks the services of fully qualified Mining Engineer. Must be under 40, good educational background, of Executive calibre and have strong industrial experience.

Contact: GLADYS HUNTING
DRAKE PERSONNEL
Suite 1009 Chicago 2, Ill. — 7 West Madison Financial 6-2100

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42 St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

WANTED—SENIOR Research Metallurgist. Age under 45. Broad research concentration and flotation, also some operating experience. Some copper leaching experience desirable. 3-year contract. Strong long established American company. Mediterranean area. Excellent living conditions. Submit record of education and experience with references. P-5747 Engineering & Mining Journal.

POSITION WANTED

SUPERVISORY CAPACITY—22 years experience in development and production of non-ferrous metals, also experimentation in underground projects in this country, Europe Asia and Africa. Experience in selection and training of workers. Age 44, married, 3 children. PW-5836, Engineering & Mining Journal.

POSITION WANTED

MINING ENGINEER. Broad experience metal, non-metal mining, and construction. Position desired with established concern. Employed, 49, married. PW-5513, Engineering & Mining Journal.

FOR SALE

For Sale or Lease
250 acres of developed low grade Copper, Silver Property also large Statuary white Marble Quarry. For information write Michael Serasio, R-4—Box 491, Tucson, Arizona.

1000 Acres Proven Manganese
lands in heart of Batesville-Cushman quadrangle, producing now, will sell. Write Bee Vanemberg, Owner, Batesville, Arkansas.

FOR SALE
OPEN PIT COPPER MINE
720,000 tons 1¼% Silicate Copper Ore blocked out by drilling. Pilot plant treated 75,000 tons sulphuric acid leaching—excellent results.
BO5474, Engineering & Mining Journal, 330 West 42nd St., New York 36, N. Y.

We Specialize in Buying Complete Mining, Milling or Construction Plants
We have purchased 14 within three years. Please contact us before you sell.
BO 5701 Engineering & Mining Journal
520 N. Michigan Ave., Chicago 11, Ill.

OPEN PIT MINING

Contractor with excellent equipment and experienced personnel interested in excavating, material handling, or open pit mining work.
CW1319 — Engineering & Mining Journal
330 W. 42nd St., New York 18, N. Y.

WANTED INDUSTRIAL PLANTS

Will arrange thru purchase of (1) capital stock, (2) Assets, (3) Machinery and equipment, whole or in part—Personnel usually retained, strict confidence. Box 1351 Church Street Station, New York 8, N. Y.

EARTHMOVING MEN

Caterpillar Tractor Co., Peoria, Illinois, has responsible positions open for field representatives to live and serve in continental United States. Knowledge of time study and techniques important. Experience with track-type tractors, wheel-type tractors or tractor-mounted shovels essential. Civil engineer graduate preferred. Send full particulars of experience and education to

MR. R. D. EVANS,
Sales Development Division,
Caterpillar Tractor Co.,
Peoria 8, Illinois.

JUNIOR METALLURGISTS

Large copper company operating in Chile, South America, requires Junior Metallurgists for test work in ore dressing and Junior Metallurgists for test work in copper smelter. Three year contract, all travelling expenses paid. Men selected will have to pass physical examinations. Submit full details, giving age, education and experience.
P5816 Engineering & Mining Journal
330 West 42 St. New York 36, N.Y.

SALES ENGINEER

Excellent opportunity in the home office of the Export Division of a major midwest manufacturer of heavy machinery for a man who knows machinery used for mining, quarrying and cement plant operations. Our employees know of this ad.

RW5850 Engineering & Mining Journal
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When Answering BOX NUMBERS . . .

to expedite the handling of your correspondence and avoid confusion, please do not address a single reply to more than one individual box number. Be sure to address separate replies for each advertisement.

Auction Advertising Page 204

MORSE DEPENDABLE RECONDITIONED MACHINERY

LOCOMOTIVES

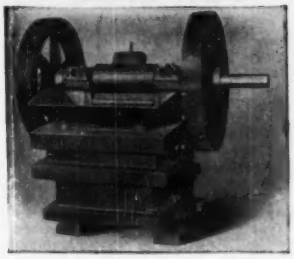
1—2½ ton Jeffrey, battery, 24" ga.
1— 4 ton Ironton, battery, 36" ga.
3— 6 ton Ironton, battery, 36" ga.
1— 6 ton Atlas, battery, 36" ga.
1—2¼ ton Mancha battery, "Titan A" 24" ga. with 2 sets Edison batteries and charging set.
1—2-2½ ton Whitcomb battery, 24" gauge
2—7 ton G.E. permissible type battery, 36 gauge
2— 8 ton G.E. battery, 36" gauge
4—10 ton Atlas battery, 36" gauge
1— 3 ton Whitcomb gas engine driven, 24" gauge
1— 3 ton Ruth gas engine driven, 18" gauge
1— 6 ton Goodman trolley, 36" gauge
2—8 ton Goodman battery, 36" ga.
2—5 ton Mancha battery, 36" ga.
1—5 ton Jeffrey battery, 36" ga.
2—8 ton Goodman trolley, 36" ga.
1—5 ton Goodman trolley, 36" ga.

FLOTATION MACHINES

2—6' Cell Stearns-Roger, 18".
1—NEW 6 Cell Morse JETAIR No. 30
1—NEW Morse Jetair #7 Hydro-cell
1—Fagregan Single Cell
1—6 Cell Denver #18 "Sub A"
2—6 Cell Denver #21 "Sub A"

FILTERS

2—6' 2-disc American Filters
1—6' 3-disc American Filter
1—8'6" 8-disc Morse Filter
1—4' x 2" Dorreo Filter
1—4' x 6' Morse Drum Filter
1—4' Single Disc Oliver Filter



JAW CRUSHERS

1—12" x 18" Universal
1— 9" x 15" Farrell
1—10" x 16" Hendy
1— 8" x 24" Rogers
1— 8" x 36" Universal
1— 9" x 36" Cedar Rapids
1—24" x 13" Farrell
1— 8" x 15" Wheeling Crusher
1— 9" x 14" Universal, No. 3M

HOISTS—ELECTRIC

1— 10 HP Vulcan #0 Single Drum
1— 15 HP Morse New Single Drum
1— 20 HP H&B Single Drum
1— 22 HP Vulcan #1¼ Single Drum
1— 30 HP Vulcan Single Drum
1— 3 HP Vulcan Double Drum
1— 3 HP Single Drum
2— 52 HP Vulcan #4¼ Single Drum
1— 50 HP Fairbanks-Morse Single Drum
1— 60 HP H&B Single Drum
1— 60 HP Vulcan #23ELF Single Drum
2—150 HP Vulcan Single Drum
1—350 HP Dillon-Box Single Drum
1—600 HP Box Single Drum

BALL & ROD MILLS

1—5' x 6' Marcy Ball Mill
1—4' x 4' Standard Ball Mill
2—6' x 48" Hardinge Conical Ball Mills with ore swept equipment.
1—8' x 22" Hardinge Conical Pebble Mill.
1—3' x 8' Marcy Rod Mill

MISCELLANEOUS EQUIPMENT

1—12' Dorr Lowhead Thickener arranged for mounting on 10' deep wooden tank.
1—24' Dorr Lowhead Thickener arranged for mounting on 12' deep wooden tank.
3—Wilfley No. 6 Concentrating Tables.
1—24" x 15' Al. Ch. single screw Log Washer.
1—48" x 15' Dorr Duplex Multizone Rake Classifier.
1—40" x 20' Akins Classifier
1—4' Symons Cone Crusher

MORSE BROS. MACHINERY COMPANY

KNOWN THE WORLD OVER FOR DEPENDABLE MINING AND MILLING MACHINERY • ELECTRICAL, INDUSTRIAL, AND CONSTRUCTION EQUIPMENT

ESTABLISHED 1898 — DENVER 1, COLORADO, U.S.A. — (CABLE MORSE)

FORK LIFT—Towmotor 4000# gas.
HAMMER MILLS—Wms. LG 1, BX 825, Reg. #1 — GA 30, Penna./125 HP
PULVERIZERS—Raymond 54" high side roller mill.—Hercules Jr.—Sturt. #1 Ring Roll.
SCREENS—Hummer 3x5-1/2/3 deck. Selectro 18"x48".
SEPARATOR—Raymond 6' Whizzer.
BUCKET—2 yd. Wms. Clamshell.
CARS—Side dump 2½ yd. 36" ga.
LOCOMOTIVE—5 ton, 36 ga. gas.
HARDINGE MILLS—7'x48", 8'x22', 10'x36" w/motors.
ROTARY KILNS—4'x30', 5'x40', 6'x80', 8'x80'.

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Track Accessories
LEFTON INDUSTRIAL CORP.
Genl. Office: 212 Victor St.
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For Sale — Steam Engine

Corliss, one cylinder, 75 H.P. and will develop as high as 100 H.P., operates at 80 R.P.M., controlled by belt-driven governor. Unit is equipped with steam separator. Countershafts and 2-ply leather belt, in excellent condition. Price $1320.00 f.o.b. car Tacony, Phila. 35, Pa.

FB 5252 Engineering & Mining Journal
330 W. 42 St., New York 36, N. Y.

---

16 SURPLUS NEW BELT CONVEYORS

36 INCH 1-100' — 2-250' — 1-329' — 1-400'
1-592' — 2-1000' & 1-1800' Long.
42 INCH 1-144' — 1-200' — 1-377' — 1-575'
2-700' — 1-800' & 2-1500' Long.
10 SURPLUS MERRICK E WEIGHTOMETERS
For 24" — 36" & 42" Belt.

REDUCTION CRUSHERS

3 Ft. Traylor TY Gyratory
#530-R Allis Chalmers Gyratory

AIR COMPRESSORS

9 Electric 5,000, 3,865, 3,178, 2,200, 1,578 & 1,302
1,090, 678 & 500 Cfm.
8 Diesel 1,578, 1,000, 678 & 500 Cfm.

LOCOMOTIVES AND CRANES

12 Diesel 100, 80, 65, 45, 30, 20 Ton Locomotive.
22 Gas, 35, 25, 18, 12, 8 & 6 Ton Locomotive.
30 Ton Orton Diesel Locomotive Crane.

R. R. CARS

100 Dump Cars, 2, 4, 12, 20 and 30 Yd.
100—80 Ton Flat Cars 86—50-Ton Gondolas.
150—6,000 & 10,000 Gal. Cap. Tank Cars

TUNNEL MUCKERS—LOADERS

4 Gardner Denver GD9 & GD14.
10 Eimco 12B & 21, 4 Sullivan ML20.

LARGE JAW CRUSHERS

7—60x84", 42x48", 36x42", 24x36" & 48x60".

ROTARY DRYERS AND KILNS

4'x20', 4'x45', 8'x33' & 7'x28'
Single and Double Shell.
Kilns, 6'x60', 4'x45', 9'x170' & 5½'x7"x80".

BALL, ROD & TUBE MILLS & CLASSIFIERS

2—5'x22' A.C. Tube Mills
4½'x10", 5'x22", 5'x22', 6'x22' & 10'x36" Hardinge Conical Ball Mills.
6'x6', 6'x10', 7'x8' and 8'x8' Cylindrical Ball Mills
8', 10' & 16' Mechanical Air Separators.
36" & 60" Spiral and 6x20 Dorr Rake Classifier.
5'x12', 5'x14' & 8'x12' Rod Mills, Marcy, Hardinge.
Dings 1-R-3-60" Rolls, Mag. Separator.
200, 400 & 500 HP—Double Drum Mine Hoists
75, 300, 450, 500 & 600 HP Single Drums.

STEEL STORAGE TANKS

40—10,000 Gal. R. R. Car Tanks.

PULVERIZERS

Hercules Jr. & #1 & 2 Ring Roll.
STANHOPE, 60 E. 42nd St., New York 17, N. Y.

FOR SALE

Excellent Condition
Hardinge 10' x 36" Ball Mill (300 H.P. Motor)
Hardinge #120 Loop Classifier
(100 H.P. Motor with Fan)
66 Tons Forged Steel Balls
Inspection Invited
MANGANESE, INC.
Box 2086, Henderson, Nevada

CLAM SHELL BUCKET: Hayward 2-½ yd. cap., type E, with new spare parts.

LOCOMOTIVE CRANE: American 25 ton, standard R. R. gauge, 50 ft. boom, gasoline powered.

MINE HOISTS: 1—Vulcan single drum 3' dia., 2'6" face, 75 H.P., 220 volt, NEW condition. 1—150 H.P., 6'6" dia., 6'8" face. 1—Vulcan double drum, 8' dia., 4' face, one clutched, 200 H.P. motor. 1—250 H.P., 72" dia., 48" face. All 3 phase, 60 cycle, 2200 volt with control equipment.
Head Frame for double shaft 16'9" x 17'2", height 55 ft., with or without 8 ft. dia. sheaves for 1-½" rope.
Other Hoists 100 H.P. to 1050 H.P., single and double drum with electrical equipment.

COMPRESSOR: Worthington DC2, 29/18-½ x 21, motor 600 H.P. synchronous, 440 volt, with all auxiliary equipment.

BOOT BUCKET ELEVATORS: Buckets size 12" x 7" on chain 40 ft. long center to center, with motors and drives.

CRUSHERS, JAW: Sizes 12" x 15" to 48" x 60".

CRUSHER, ROLL: Traylor 18" x 42", heavy duty.

CRUSHER SPECIAL: Pioneer 30" x 42", all steel, roller bearings, condition like NEW.

CRUSHING PLANT: Cedar Rapids, portable, 2 unit type, capacity 40 yds. per hour.

DRYERS or KILNS: 2—10 ft. x 90 ft. heavy duty, with or without auxiliary equipment, condition like NEW. Located Minnesota. 2—8 ft. x 125 ft. kilns.

CLASSIFIERS: 2—Akins 54" double pitch single screw weir type, 3 H.P. syncrogear motor, 220/440 volt, lifting device. 2—Akins and Wemco 78" double pitch, single screw, weir type, 7-½ H.P. motors, 220/440 volt, speed reducer and lifting device. Three of above located near Reno, Nevada.

BALL MILL: 3' x 4' Eimco complete, NEW, UNUSED.

ROD MILL: Marcy 8 ft. x 12 ft. NEW condition.

We Buy and Sell Equipment throughout North and Central America

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INDUSTRIAL RUBBER PRODUCTS FOR EVERY PURPOSE

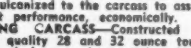
IMMEDIATE DELIVERY OF CONVEYOR, ELEVATOR AND TRANSMISSION BELTING — FIRE, WATER, SUCTION, AIR, STEAM AND WELDING HOSE

WHY WAIT

We have 8 to 48

RUBBER CONVEYOR BELTING

TOUGH COVERS—Heavy duty, specially compounded abrasive resistant rubber covers having high tensile strength. Thoroughly capable of withstanding the abrasive action of bulk materials. Properly vulcanized to the carcass to assure utmost performance, economically.
STRONG CARCASS—Constructed of finest quality 28 and 32 ounce tough cotton duck, properly treated and impregnated to avoid mildew from moisture and atmospheric conditions. Each ply thoroughly embedded in rubber to prevent ply separation.
FLEXIBILITY — Careful attention has been given in the construction of all belts to have the proper flexibility assuring the following desirable features: troughs easily, runs true on all idlers, gouge resistant, excellent for long and short hauls and slope installations.



Avoid delays in your production schedules!

We carry in stock for your immediate requirements, Conveyor Belting in widths from 8 inches to 48 inches

Width	Ply	Thickness Top Cover	Thickness Bottom Cover	Type of Duck Carcass
8"	4	1/16"	1/32"	28 Oz.
10"	4	1/16"	1/32"	28 Oz.
12"	4	1/16"	1/32"	28 Oz.
14"	4	1/16"	1/32"	28 Oz.
16"	4	1/8"	1/32"	28 Oz.
18"	4	1/8"	1/32"	28 Oz.
20"	4	1/8"	1/32"	28 Oz.
20"	5	1/8"	1/32"	28 Oz.
24"	4	1/8"	1/32"	28 Oz.
24"	5	1/8"	1/32"	28 Oz.
26"	5	1/8"	1/32"	28 Oz.
30"	4	1/8"	1/16"	32 Oz.
30"	5	1/8"	1/16"	32 Oz.
30"	6	1/8"	1/16"	32 Oz.
36"	6	1/8"	1/16"	32 Oz.
42"	5	1/8"	1/16"	32 Oz.
48"	5	1/8"	1/16"	32 Oz.
48"	6	1/8"	1/16"	32 Oz.

INQUIRE FOR SIZES NOT LISTED. ELEVATOR TRANSMISSION & V-BELTING ALSO IN STOCK.

All our belting made by the leading belting manufacturers.

Write for Free Booklet on Installation, Care & Maintenance of Conveyor Belting.

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MINE HOISTS

Denver Egrg 60" dia. 2-drum; cap. 12000# 600 FPM; pneu. & Lilly controls; 440 volts.
Vulcan 36" dia; post-brake & 75 hp 440 volts

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39 W. Adams St. — — — Phoenix, Arizona

Bucyrus-Menighan 1150-B 25-yd. elec. Walking dragline, 180' boom, late model.
Bucyrus-Menighan 6W diesel 12-yd. Walking draglines (2), 165'-200' booms.
Marion 18-yd. elec. stripping shovel.
Bucyrus 120-B 4½-yd. 25 cycle elec. shovel.
Marion 7½-yd. and 5½-yd. diesel shovels.
Large gyratory and jaw crushers (5).
Nordberg 875 KW diesel generator set.
H. Y. SMITH CO., 828 N. B'way, Milw. 2, Wis.

FOR SALE

Rotary Kiln—Vulcan Iron Works—8' dia. x 80' long, Feed Hood, Combustion Chamber, Oil Burner and Controls, and other auxiliaries. Variable Speed Drive.

Ball Mill—Hardinge Conical 10' x 48", 2200/4400 V 400 HP Motor, Reverse Loop Classifier, Blower and Separator, Vent Dust Collector.

Sample Mill—Includes Allis Chalmers Type R 222 Crusher; Aerovibe Screen & Roll Crusher, (2) Geary Jennings Samplers, Bucket Elevators, Chutes, etc.

Thickeners—Dorr Type A with Steel Tanks, (3) 26' x 10', (1) 24' x 10', (1) 12' x 8'.

THE VULCAN DETINNING COMPANY
SEWAREN, NEW JERSEY

REFER to page 204 for AUCTION SALE of METALLURGICAL EQUIPMENT

LEGAL NOTICE

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF

ENGINEERING AND MINING JOURNAL published monthly at Philadelphia 23, Pa. for October 1, 1952.

1. The name and address of the publisher, editor, managing editor, and Adv. Sales manager is: Publisher, McGraw Hill Publishing Company, Inc., 330 West 42nd Street, New York 36, N.Y.; Editor, R. H. Ramsey, 330 West 42nd Street, New York 36, N.Y.; Managing editor A. H. Rubbell, 330 West 42nd Street, New York 36, N.Y.; Adv. Sales manager, R. W. Davis, 330 West 42nd Street, New York 36, N.Y.

2. The owner is: McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 36, N.Y.; Stockholders holding 1% or more of stock: Curtis W. McGraw and Donald C. McGraw, Trustees for Harold W. McGraw, Curtis W. McGraw and Donald C. McGraw, all of 330 West 42nd Street, New York 36, N.Y.; Curtis W. McGraw and Harold W. McGraw, Trustees for Catherine M. Bock, 330 West 42nd Street, New York 36, N.Y.; Curtis W. McGraw, 330 West 42nd Street, New York 36, N.Y.; Donald C. McGraw, 330 West 42nd Street, New York 36, N.Y.; Mildred W. McGraw, Madison, New Jersey; Grace W. Mehren, 536 Arenas Street, LaJolla, California; Touchstone & Company, c/o The Pennsylvania Company, 15th and Chestnut Streets, Philadelphia 1, Pa.

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4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustees or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

McGRAW-HILL PUBLISHING COMPANY, INC.
By J. A. Gerardi, Vice Pres. & Treas.

Sworn to and subscribed before me this 9th day of September, 1952.
[SEAL] ELVA G. MASLIN.
(My commission expires March 30, 1954)

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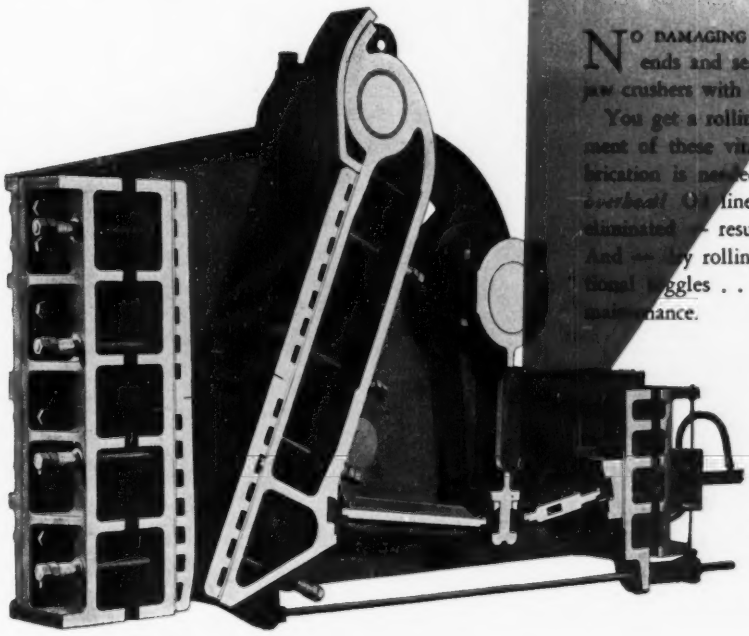

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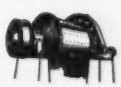

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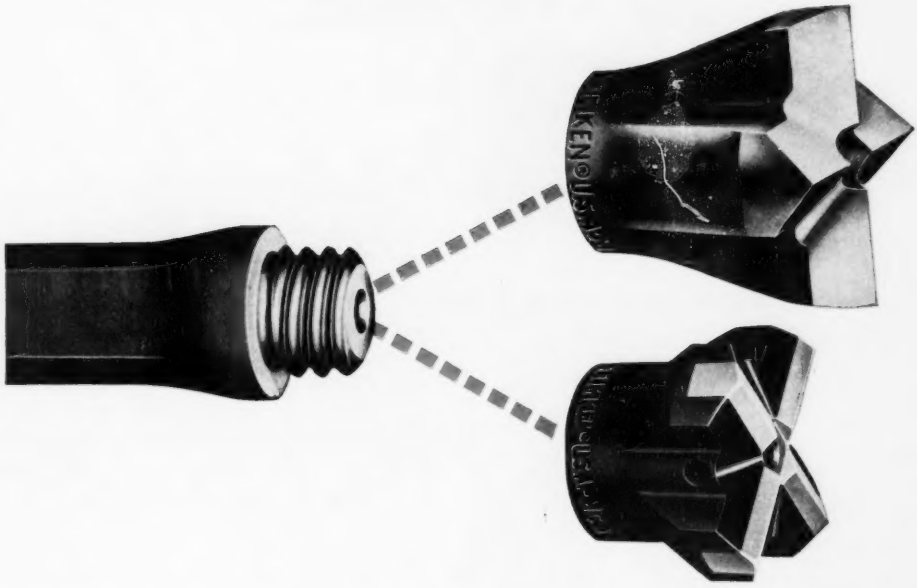

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